15 Years' View of Aerosol Dust Over the Middle East

Saviz Sehatkashani[1], Sergio Rodríguez[2]

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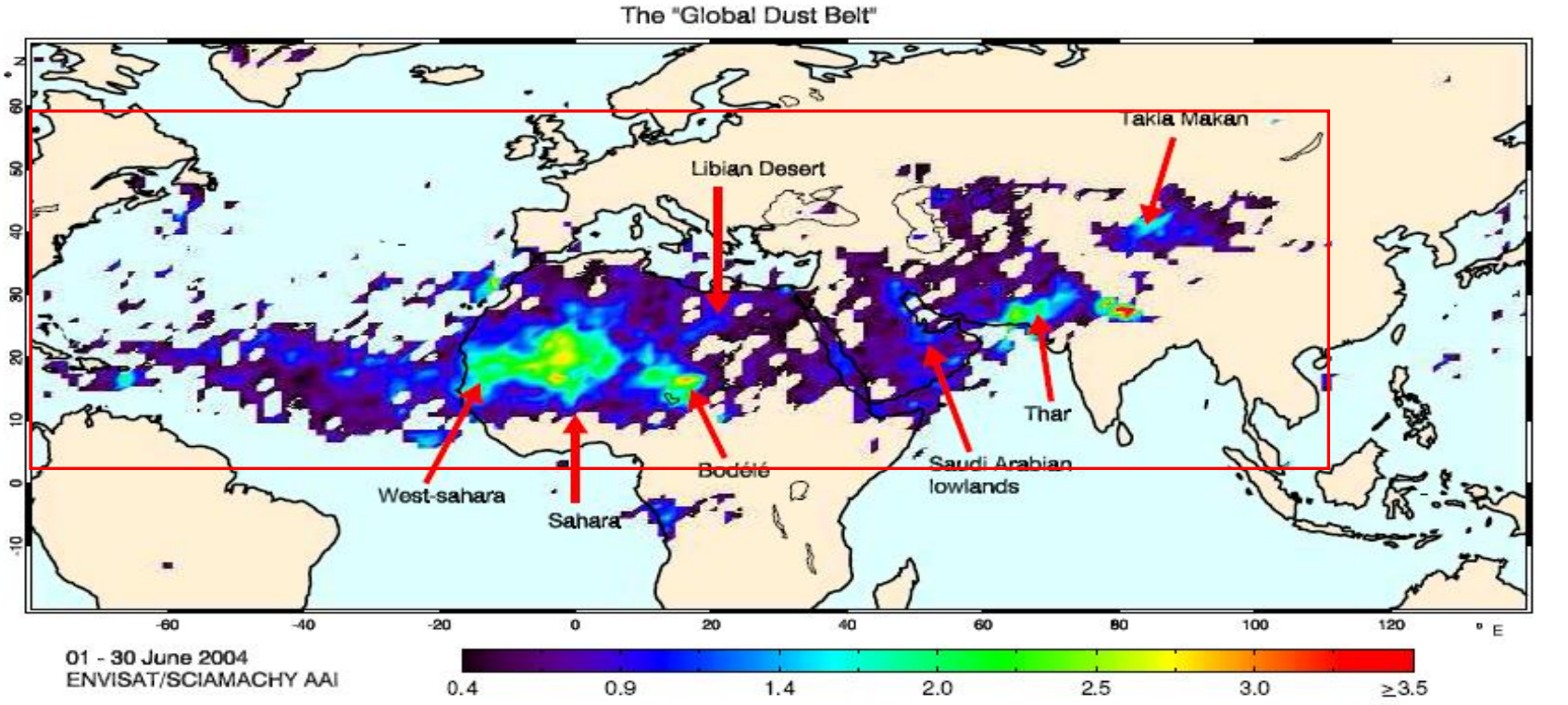
[2] Izana Atmospheric Research Centre, AEMET, Tenerife, Spain, srodriguezg@aemet.es.

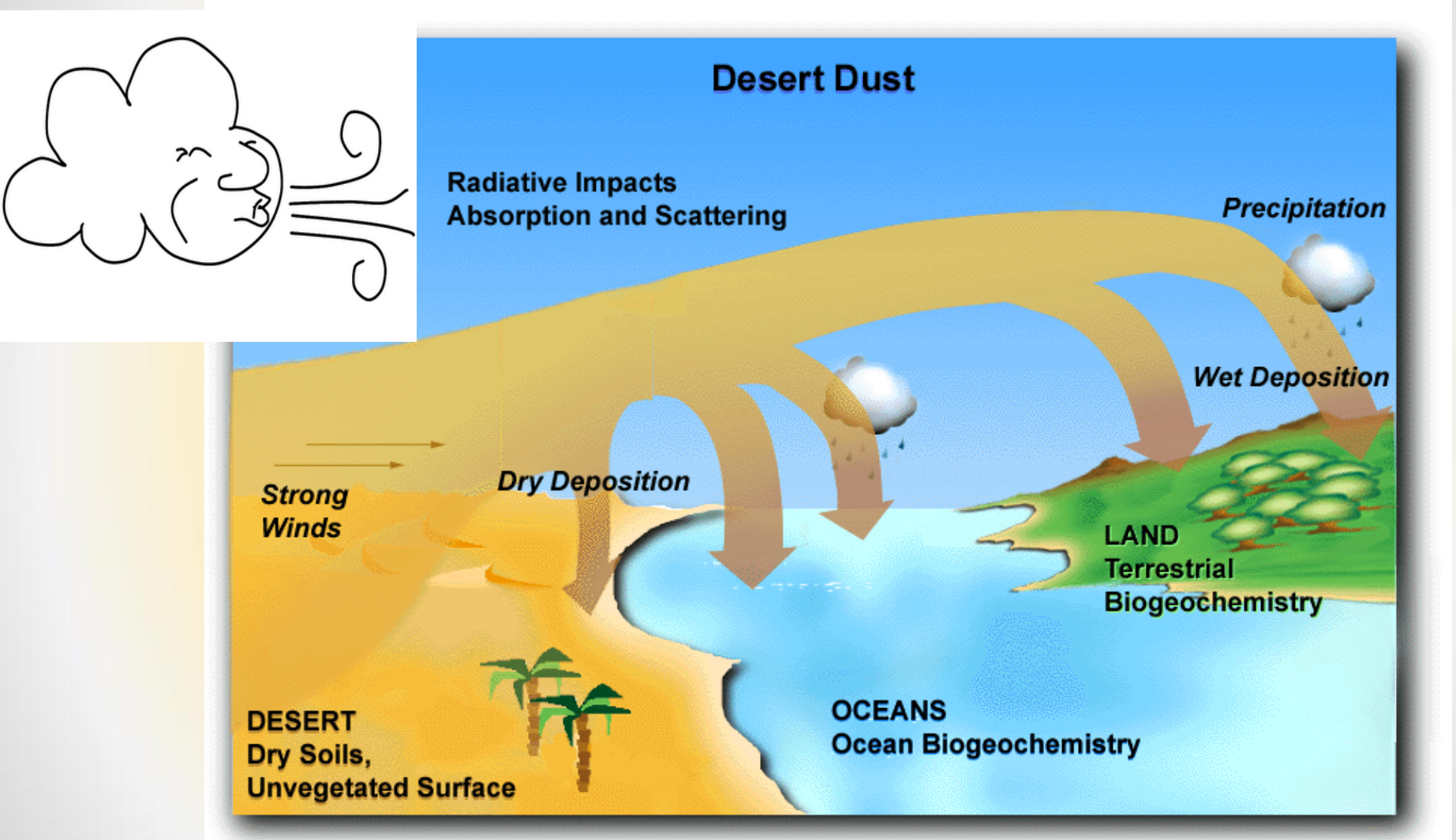
Background

Dust Climatology over West Asia



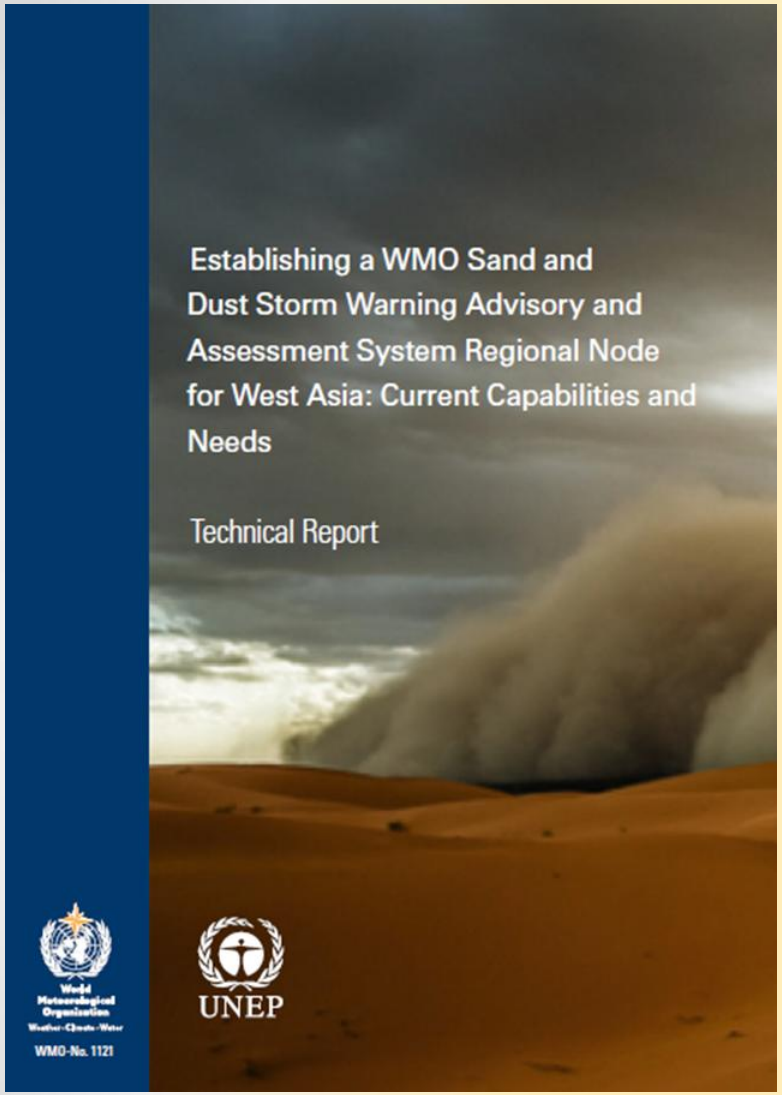
(de Graaf, 2006)

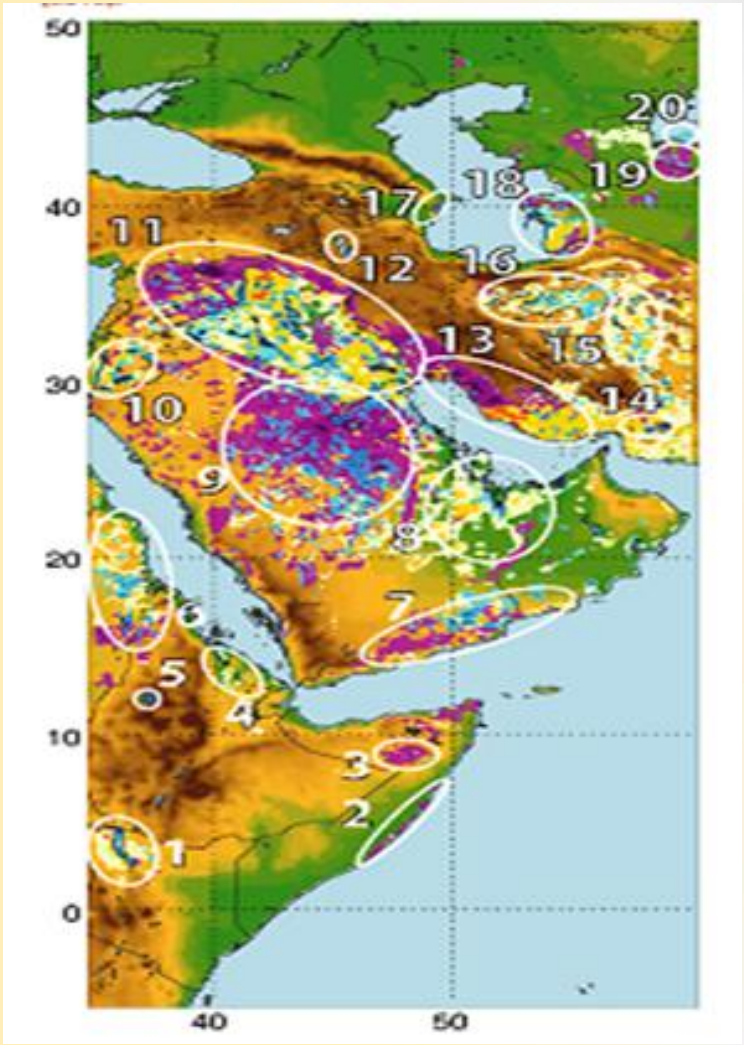
Mineral dust in the Earth climate system:

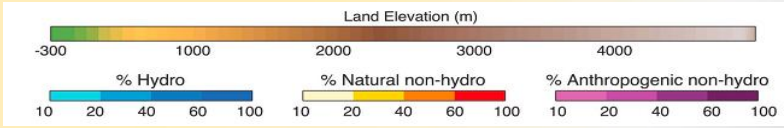


Direct and indirect radiative forcing, ocean and terrestrial biogeochemistry and atmospheric chemistry (Mahowald et al., 2002)

Background





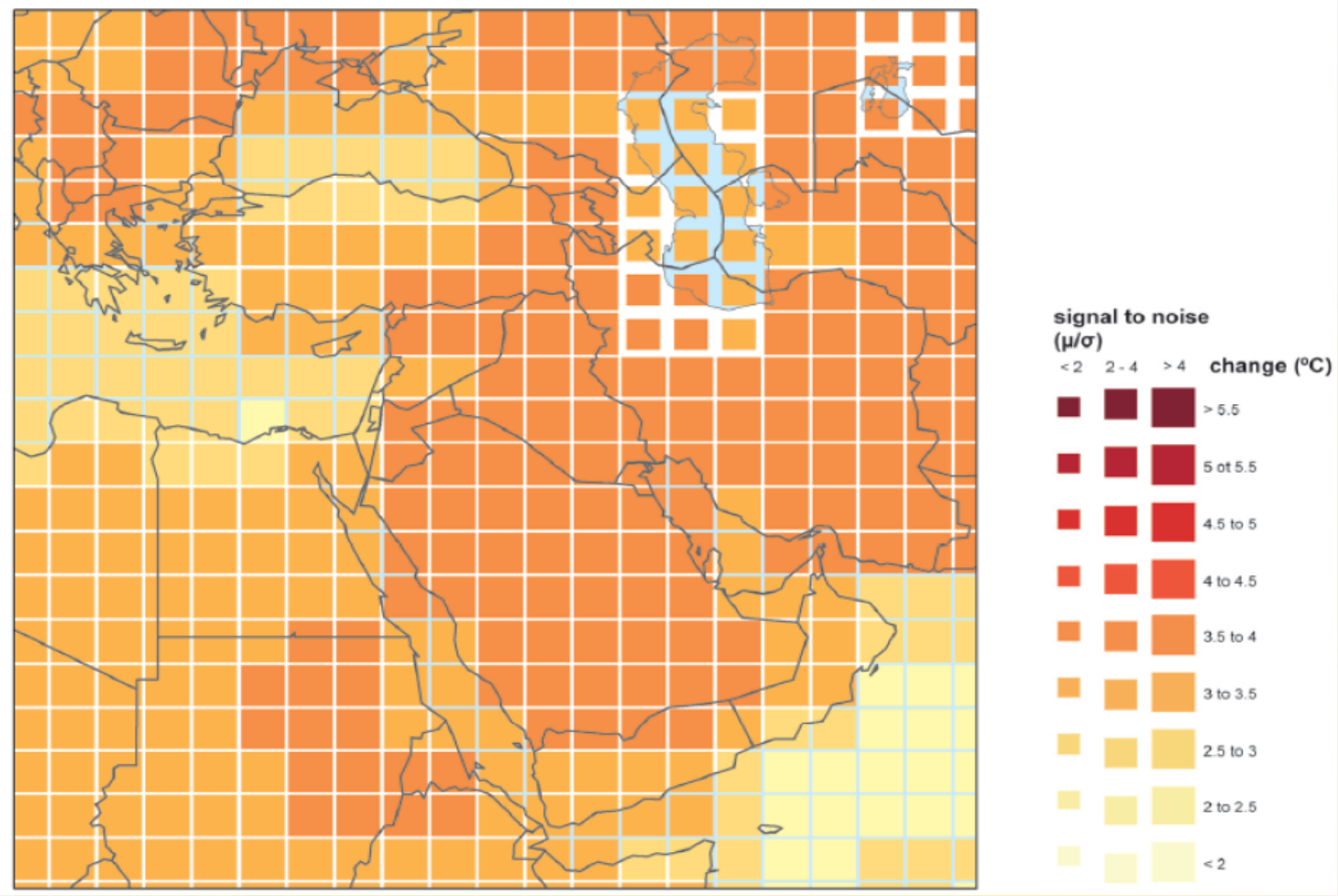


Available at:
http://www.wmo.int/pages/prog/arep/wwrp/new/documents/1121_SDS_Technical_Report_en.pdf

Ginoux et al.2012

Background

Dust Climatology over West Asia



Percentage change in average annual temperature by 2100 from 1960-1990 baseline climate, averaged over 21 CMIP3 models for West Asia. The size of each pixel represents the level of agreement between models **(Met Office, 2011).**

- http://www.wmo.int/pages/prog/arep/wwrp/new/documents/1121_SDS_Technical_Report_en.pdf

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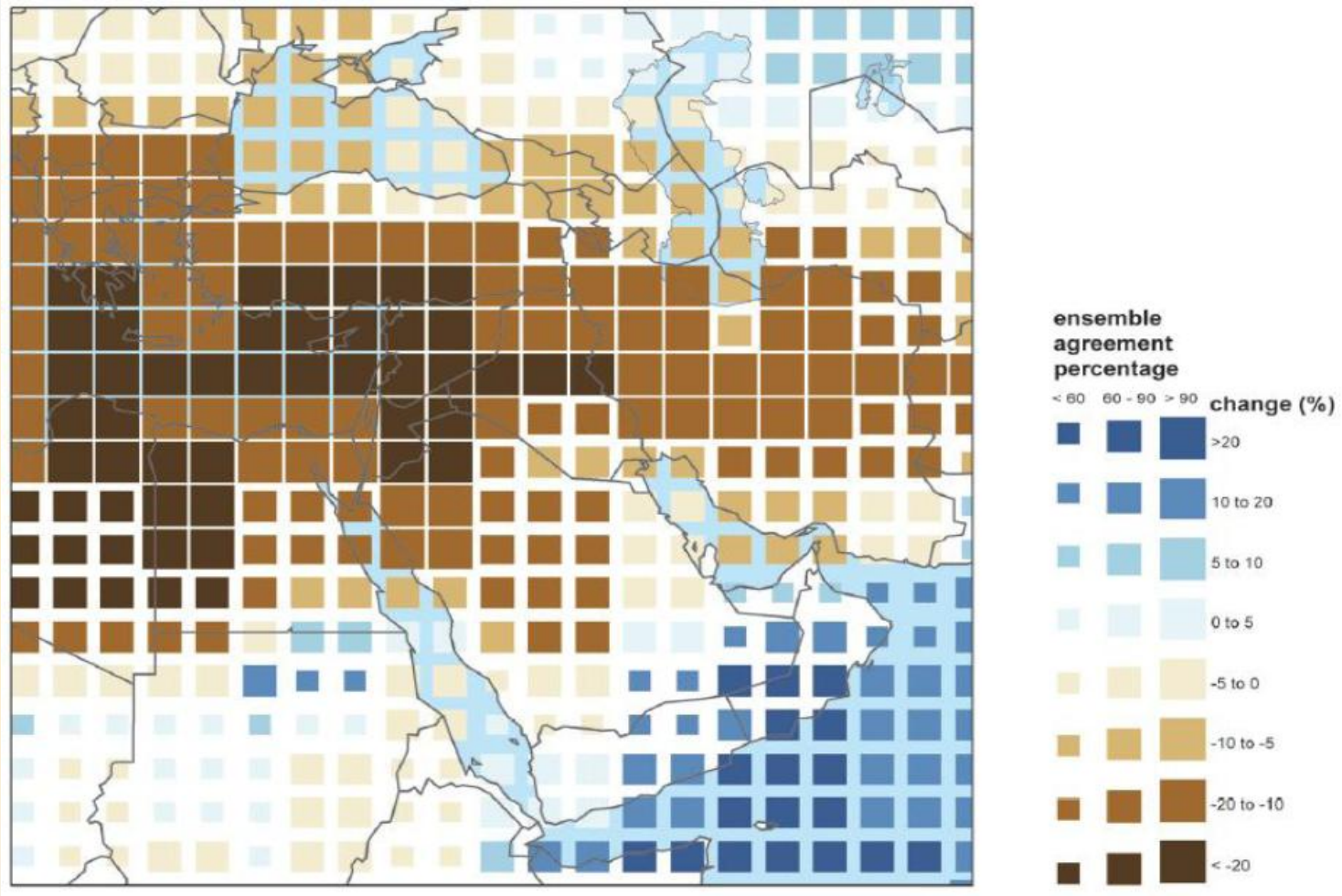
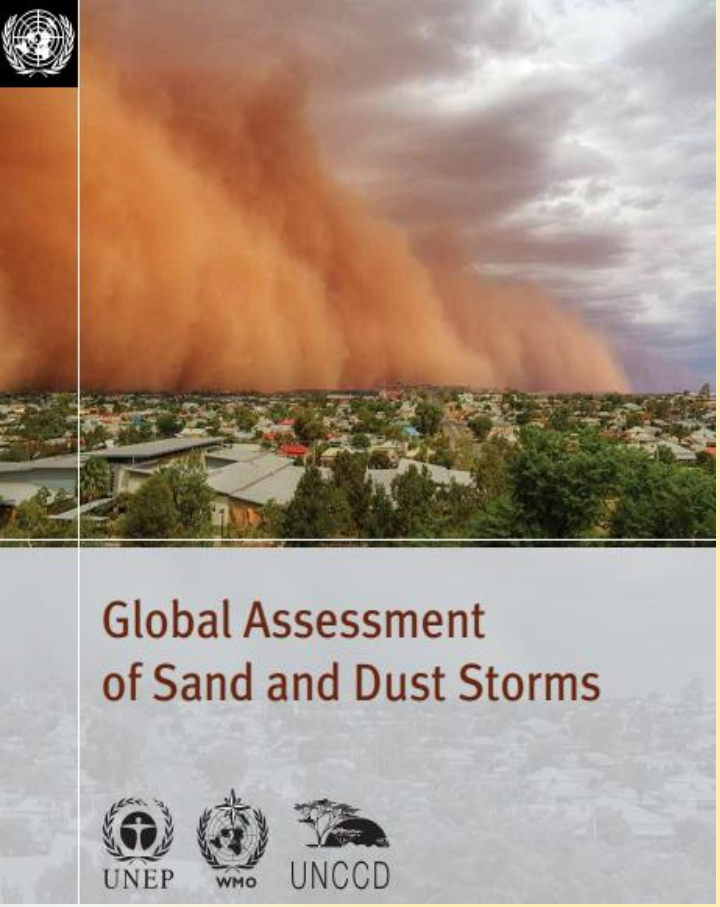
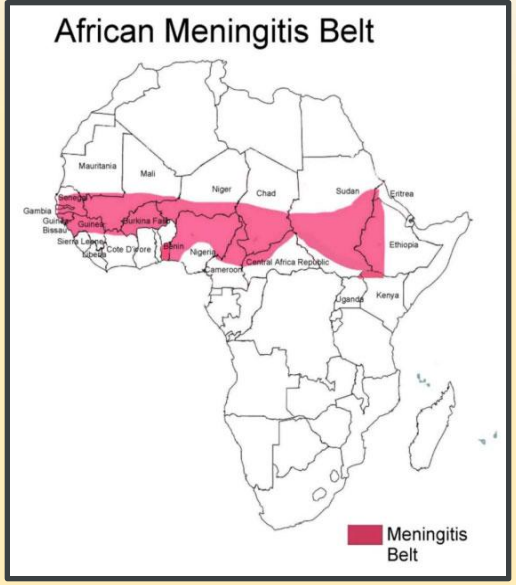
Dust Climatology over West Asia



Percentage change in average annual precipitation by 2100 from 1960-1990 baseline climate, averaged over 21 CMIP3 models for West Asia. The size of each pixel represents the level of agreement between models **(Met Office, 2011).**

http://www.wmo.int/pages/prog/arep/wwrp/new/documents/1121_SDS_Technical_Report_en.pdf





Human Health
(Asthma, infections, Meningitis in Africa, Valley Fever in the America's)

World Health Organization

World Meteorological Organization
Weather · Climate · Water

Zabol: highest for PM2.5s

Zabol, an eastern Iranian city on the border with Afghanistan, was once at the heart of a bustling ancient civilisation, close to where the very first piece of animation came from in the form of an intricate pottery bowl dating back 5,000 years that displays a goat in motion.

But the city is now a largely neglected area plagued by poverty - and pollution.

Every summer, as temperatures rise to staggering levels of 40C or even higher, Zabol is struck by what is locally known as "120 days of wind", relentless dust storms from north to south.

News ID: 1467182 Service: Society/Culture
July, 17, 2017 - 17:04

TEHRAN (Tasnim) – More than 5,000 local residents in Iran's southeastern Sistan region have received medical treatment in hospitals as a persistent sandstorm, part of annual '120-day winds', is tearing through the area.

Examples of cooperation between WMO SDS-WAS & IRIMO

case occurred in Sistan-Baluchestan, an Iranian province located in the SW of the country, along the border with Afghanistan and Pakistan. A progressive dessication of the wetlands caused by climate change, by a prolonged drought and by overuse of water resources on both sides of the border, has turned this province into one of the dustiest places on the planet (Alizadeh-Choobari et al., 2014). In particular, the disappearance in the early 2000s of the nearby Hamoun lake has exacerbated the situation in the city of Zabol to an unprecedented extent.

Figure 6: According to WHO, Iran's south-eastern Zabol city ranks first among the most polluted cities in the world

The Sistan endorheic basin is the most active dust source in the interior of Iran, with an average of 167 dusty days per year. Dust storms within the basin may occur at any time throughout the year, but they are more frequent from mid-May to mid-September when there is little or no precipitation and the strong northerly "wind of 120 days" (locally known as Levar) is the dominant flow. This wind is the result of a meridional pressure gradient between a persistent cold high-pressure system over the high mountains of the Hindu-Kush and a summertime thermal low over the desert lands of eastern Iran and western Afghanistan. When the synoptic situation reinforces the wind speed, entrainment of dust particles from bare soils, particularly from dried wetlands, where large amounts of erodible sediment are available, is also accelerated.

Between 13 and 14 July 2016, a strong anticyclone over the Caspian sea and a well-developed thermal low over western Afghanistan and southern Iran produced significant increase in the meridional pressure gradient, reinforced surface wind speed and strong intensification of dust release. The dust plume spread over the entire south-eastern part of Iran, as obser ved in the METEOSAT RBG-dust product of 13 July at 12 UTC, where dust is highlighted in pink colour (Figure 7). Daily-averaged PM10 reached 10,000 μg/m³ in Zabol, whereas visibility was reduced to less than 100 m (Figure 8).

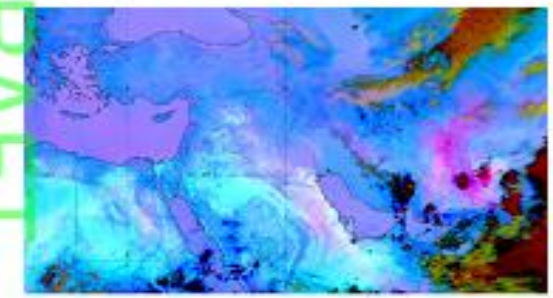


Figure 7: METEOSAT RGB-Dust product of 13 July 2016 at 12 UTC

News agencies reported that thousands of people were provided with emergency aid and dust masks by the Iranian Red Crescent as dust storms blew through the province of Sistan-Baluchistan, affecting major towns as Zabol, Zahak, Nimrouz, and Hirman along with small towns and villages.The high frequency of similar episodes makes the situation unsustainable. Decades of poor water management, depleting underground water, and policies of development that failed to consider the impact on the environment and ecosystems, have taken a toll on Iran's environmental future. Fortunately, steps have already been taken to reverse the situation, both nationally and internationally. UNEP has worked with Iran and Afghanistan to try to rehabilitate the Hamouns -seasonal or ephemeral lakes- and UNESCO has designated them as a biosphere reservoir. At a national level, authorities are revising irrigation methods and agricultural use of about 46,000 hectares of land in Sistan-Baluchistan to make farming more sustainable.

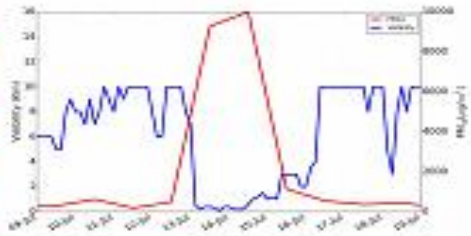


Figure 8: Daily-averaged PM10 and visibility records from Zabol

World Meteorological Organization · GLOBAL ATMOSPHERE WATCH · WWRP

WMO AIRBORNE DUST BULLETIN

Sand and Dust Storm – Warning Advisory and Assessment System

No. 1 – March 2017

WMO SDS-WAS Regional Center for Asia

website: http://eng.nmc.cn/sds_was.asian_rc

Other contributors to this issue

Sara Basart, Gerardo García-Castrillo, Faezeh Noori, Abbas Ranjbar, Saviz Sehatkashani.

Tehran Ministerial Declaration

Intl. event issues Tehran Declaration, vows to fight dust storms

July 5, 2017 Politics

TEHRAN – Ministers and high-level representatives participating in the UN-backed International Conference on Combating Sand and Dust Storms in Tehran (July 3-5) wrapped up the second day with the Tehran Ministerial Declaration, agreeing to "cooperate on combating SDS at sub-regional regional, and international levels."

Here is the full text of the declaration:

6- **Strengthen** research activities for effective monitoring, impact based assessment and forecasting and early warning mechanism for Sand and Dust Storms, to address disaster prevention and mitigation and for development of appropriate preparedness and effective response to Sand and dust storms,

7- **Encourage** enhanced regional and international cooperation to observe and forecast, mitigate and cope with the adverse effects of Sand and Dust Storms, and seek technical and financial support from the relevant United Nations organisations to that end.

8- **Consider** to further develop policy dialogue on responding to the issues of sand and dust storms among interested countries in partnership with relevant international bodies and organizations, including the establishment of a future platform, in synergy with relevant United Nations System.

9- **Recognize** the role of the Asian and Pacific Center for the Development of Disaster Information Management (APDIM), regional seas programs and SDS-WAS, to develop human and institutional capacity through strengthened regional cooperation in disaster information management.

Examples of cooperation between WMO SDS-WAS & IRIMO

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5th Training Course on WMO SDS-WAS products

Satellite and ground observation and modelling of atmospheric dust

I. R. of Iran Meteorological Organization (IRIMO),

Atmospheric Science and Meteorological Research Center (ASMERC),

European Organization for the Exploitation of Meteorological Satellites (EUMETSAT) and

Barcelona Dust Forecast Center (BDFC)

World Meteorological Organization (WMO)

When Nov 0 201

Where T

Add event to calendar

WMO OMM

World Meteorological Organization

Our ref.:RES/WWR/AER/SDS-WAS/NAMEE SG

Ms. Saviz Sehat Kashani
The I.R. of Iran Meteorological Organiz
(IRIMO)
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Islamic Republic of Iran
E-mail: intl-affairs@irimet.net

GENEVA, 27 April 2017

Subject: Membership in the Steering Group of WMO SDS-WAS Regional Node for Northern Africa, Middle East and Europe

Dear Ms. Saviz Sehat Kashani,

On behalf of the World Weather Research Programme (WWRP) and Global Atmosphere Watch (GAW) Programme of the World Meteorological Organization (WMO), I would like to welcome you as a new member of the Steering Group of WMO Sand and Storm Warning Advisory and Assessment System (SDS-WAS) Regional Node for Northern Africa, Middle East and Europe (NAMEE), chaired by Dr. Slobodan Nickovic. This Group coordinates implementation of the SDS-WAS objectives in the NAMEE region and reports to the global SDS-WAS Steering Committee, chaired by Dr. Enric Terradellas. The work is further guided by the World Weather Research Programme Scientific Advisory Committee (WWRP-SSC) chaired by myself. The WWRP-SSC has been established by the WMO Commission for Atmospheric Sciences (CAS), whose President is

Examples of cooperation between WMO SDS-WAS & IRIMO

WMO Sand and Dust Storm Warning Advisory and Assessment System (SDS-WAS)

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- Cooperation between Spain and Iran in the framework of SDS-WAS

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Latest News

New members of the SDS-WAS Regional Steering Group for Northern Africa, Middle East and Europe
Jul 24, 2017

Cooperation between Spain and Iran in the framework of SDS-WAS
Jul 24, 2017

WMO supports the International Conference on sand and dust storms currently held in Tehran
Jul 04, 2017

Upcoming Events

Goldschmidt 2017. Session 9H: Variability of dust composition
Aug 13, 2017 - Aug 18, 2017 — Paris, France

16th AeroCom, 5th AeroSAT meeting
Oct 09, 2017 - Oct 13, 2017 — Helsinki, Finland

International Workshop on

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Cooperation between Spain and Iran in the framework of SDS-WAS

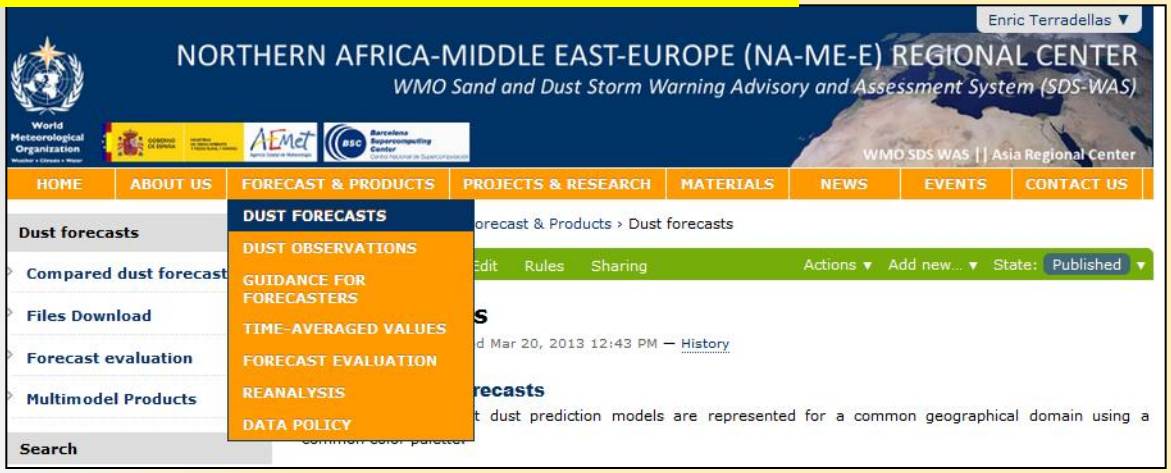
by Enric Terradellas — last modified Jul 24, 2017 10:13 AM

Dr. **Saviz Sehat Kashani**, Academic member of **Atmospheric Science and Meteorological Research Center** (ASMERC) of the Islamic Republic of Iran Meteorological Organization (IRIMO), participated in the training course on "**Atmospheric Aerosols and Mineral Dust**". The training course was organized by the **WMO Sand and Dust Storm Warning Advisory and Assessment System** (SDS-WAS) Regional Centre for Northern Africa, Middle East and Europe, hosted by tha State Meteorological Agency of Spain (AEMET) and the Barcelona Supercomputing Centre. It was held at the AEMET's Izaña Atmospheric Research Centre (IARC) from 20th June to 6th July 2017.

During the event, Dr. Sehat received information from Dr. **Emilio Cuevas** on the SDS-WAS program and specifically on mineral dust observation, complementarities and synergies between SDS-WAS and the WMO Global Atmospheric Watch (GAW) program

Dr. **Africa Barreto** introduced the main concepts of lidar technique and presented the lidar program conducted at the IARC to characterize the vertical structure of the Saharan Air Layer (SAL). Dr. **Carmen Guirado** was in charge of detailing operational and research aspects of solar photometry techniques and specifically the AERONET program and the European ACTRIS project. She provided practical information on sun photometry calibration by using the handheld Calitoo (Tenum) sunphotometer, and on activities carried out at the optical laboratory.

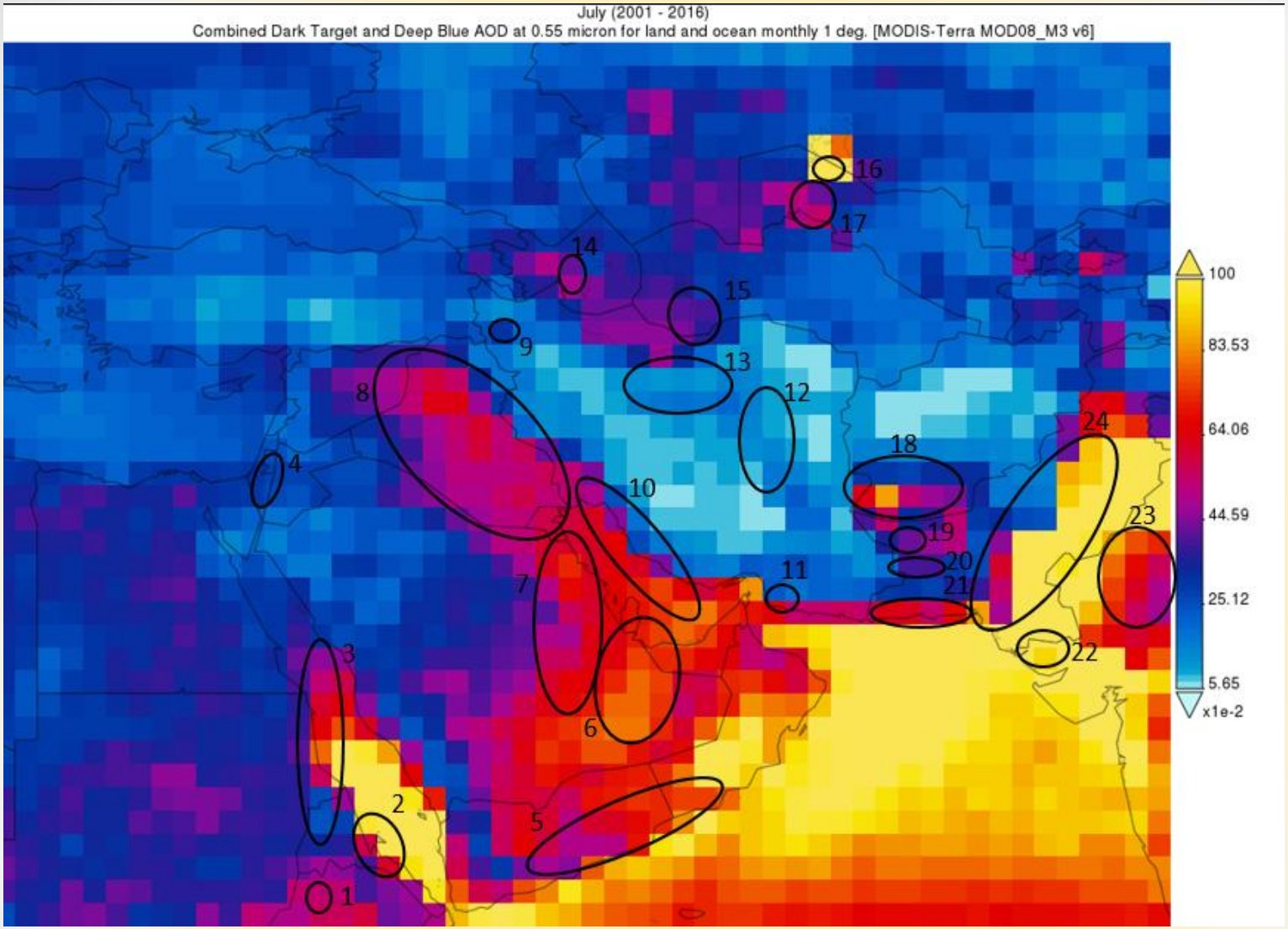
Current need for Validation of NWP over west Asia



BSC-DREAM8b v2.0	DOWNLOAD FILES	Model website	BSC Barcelona Supercomputing Center
MACC-ECMWF	DOWNLOAD FILES	Model website	macc
DREAM-NMME-MACC	DOWNLOAD FILES	Model website	SEEVCCC
NMMB/BSC-Dust	DOWNLOAD FILES	Model website	BSC Barcelona Supercomputing Center
NASA-GEOS-5	DOWNLOAD FILES	Model website	NASA
NCEP-NGAC	DOWNLOAD FILES	Model website	NCEP
Multimodel MEDIAN	DOWNLOAD FILES	Model website	WMO AEMet BSC

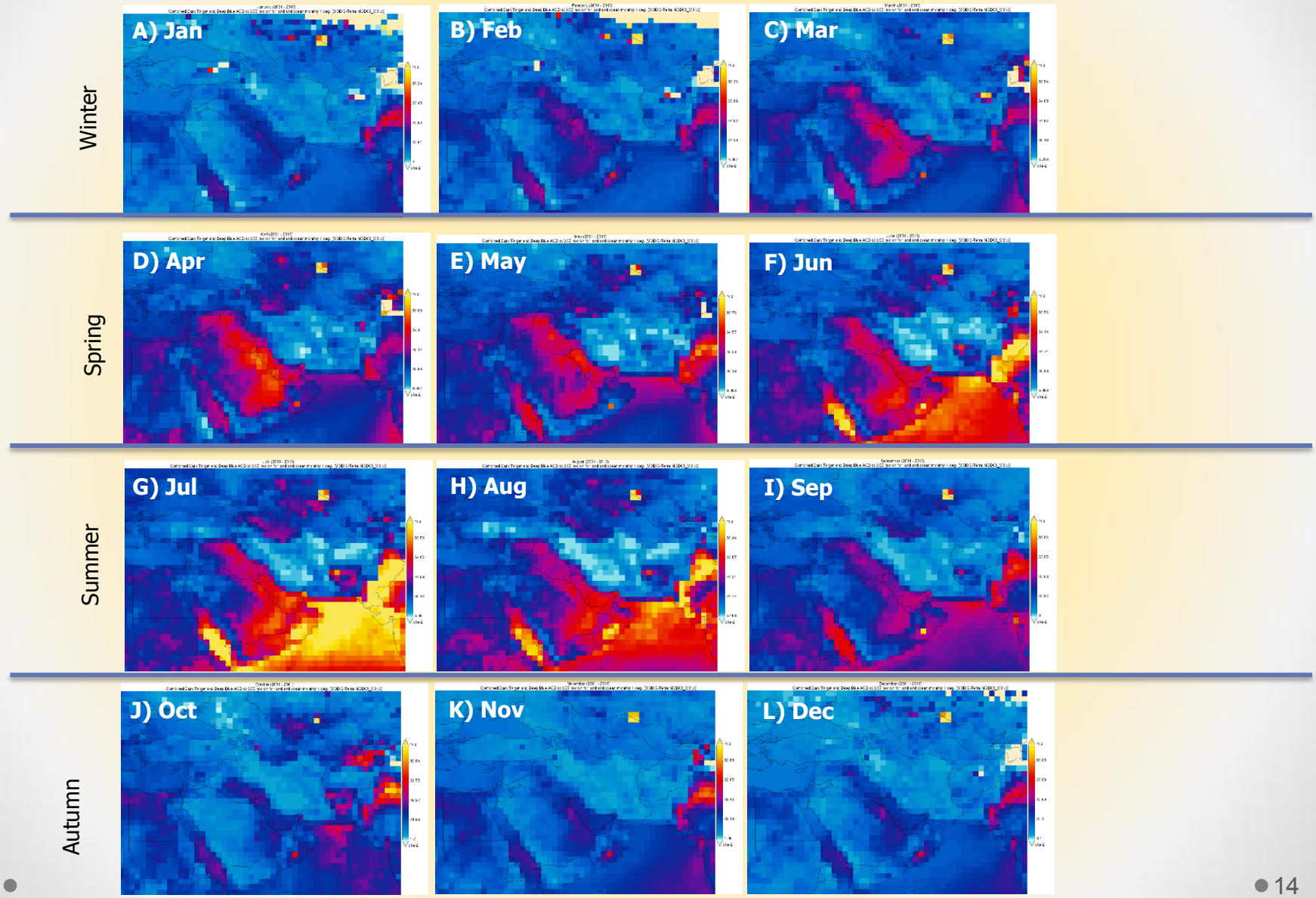
WMO SDS-WAS IMPLEMENTATION PLAN 2015-2020

Distribution of dust sources over the Middle East



Distribution of dust sources over the Middle East. The black circled sources are numbered as 1, Lake Tana of Ethiopia; 2,Danakil Desert of Ethiopia3, northeast Sudan; 4, Jordan River 5, Hadramawt region; 6, Empty Quarter; 7, highlands of Saudi Arabia; 8, Mesopotamia; 9, Urumia Lake of Iran; 10, coastal desert of Iran; 11, Hamun-i-Mashkel; 12, Dasht-e Lut Desert of Iran; 13, Dasht-e Kavir Desert of Iran; 14,Qobustan in Azerbaijan; 15, Atrek delta of Turkmenistan; 16, Aral Sea, 17 Turan plain of Uzbekistan; desert of Rajasthan in India; 18, southern drainage basin of the Hindu Kush in Afghanistan; 19, ephemeral lakes around the city of Zabol; 20, Hamun-i-Mashkel of Pakistan; 21, Makran coast of Pakistan; and 22, Rann of Kutch in India ; 23, desert of Rajasthan in India

Seasonal Distribution of AOT over the Middle East

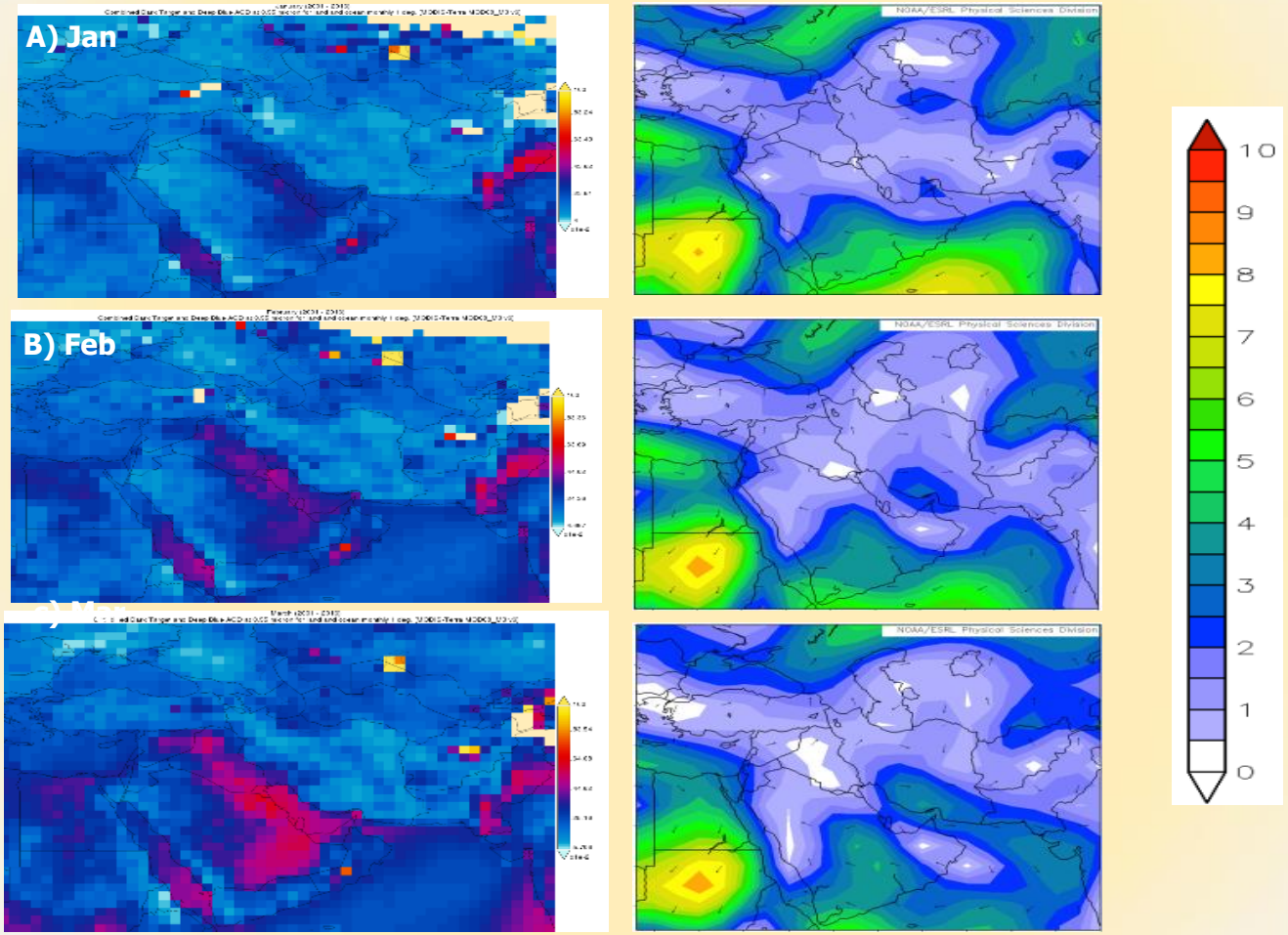


Seasonal Distribution of 925mb wind field and AOT over the Middle East

Winter

MODIS MOD08

NCEP/NCAR Reanalysis
925mb Vector Wind (m/s) Composite Mean



2001-2016

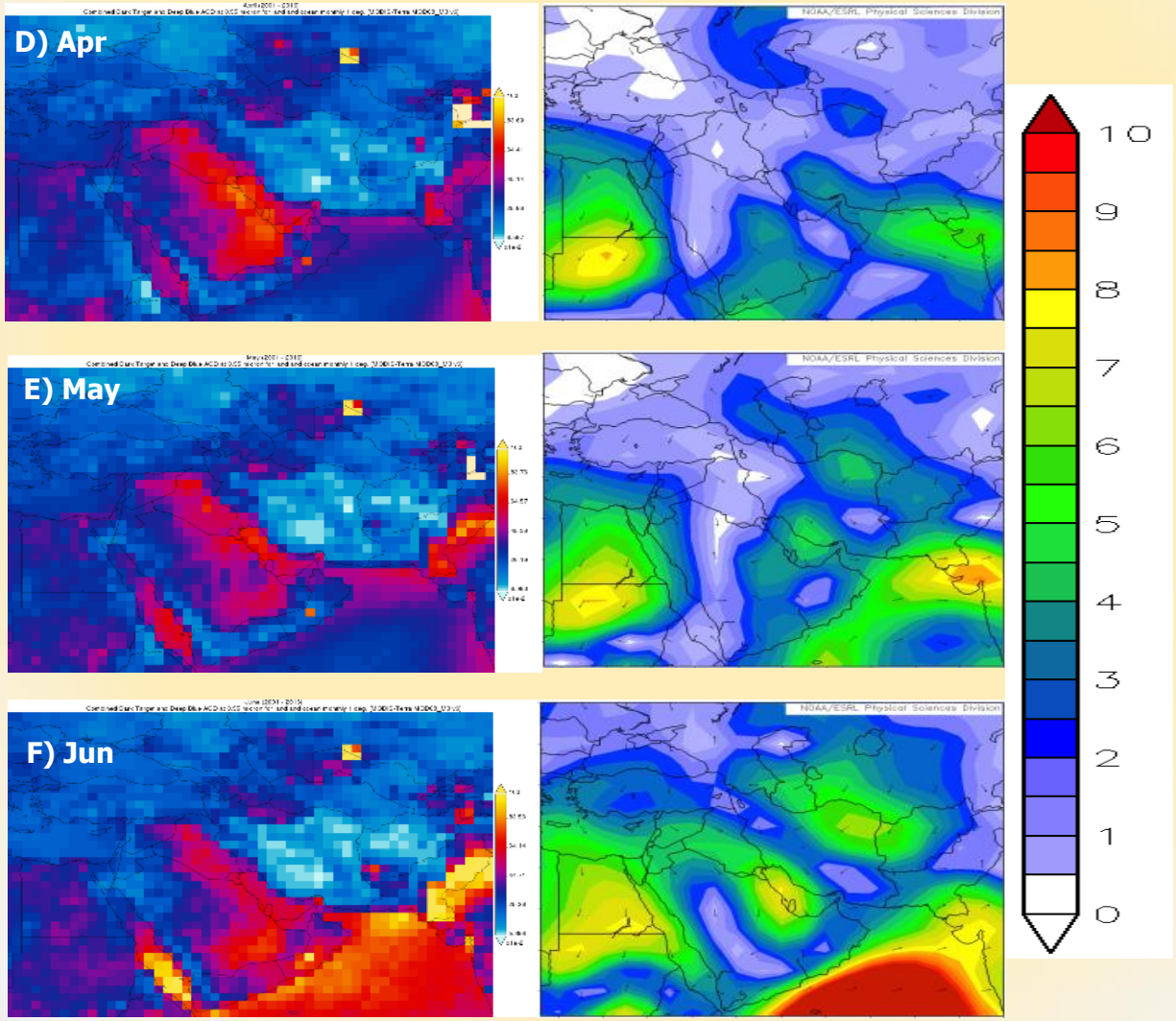
12-50 ºN, 23-75ºW

Seasonal Distribution of 925mb wind field and AOT over the Middle East

MODIS MOD08

NCEP/NCAR Reanalysis
925mb Vector Wind (m/s) Composite Mean

Spring



Seasonal Distribution of 925mb wind field and AOT over the Middle East

MODIS MOD08

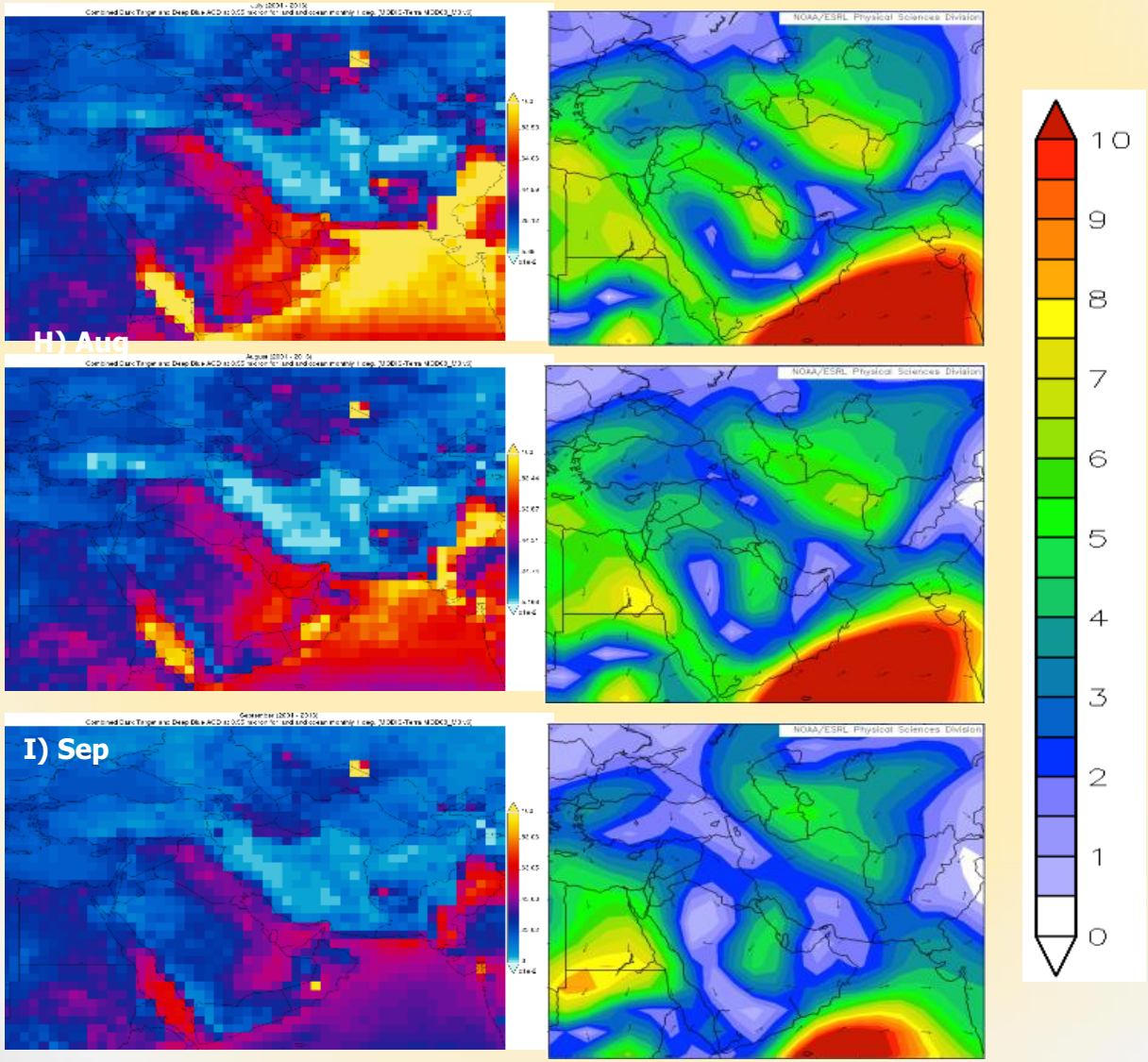
NCEP/NCAR Reanalysis
925mb Vector Wind (m/s) Composite Mean

Summer

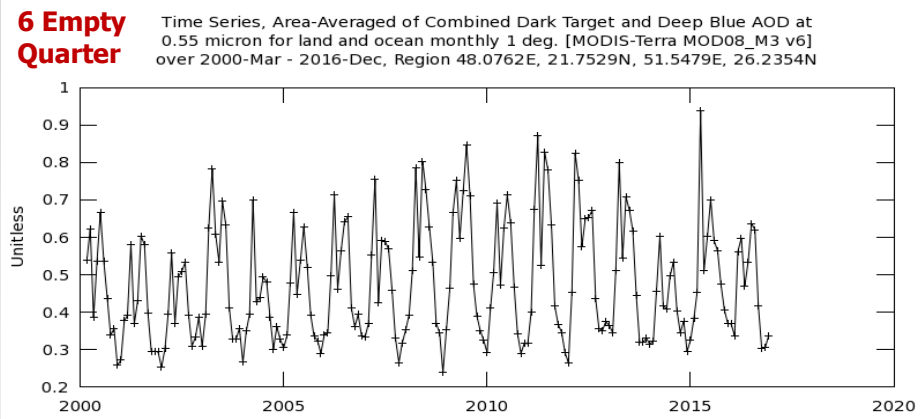
G) Jul

H) Aug

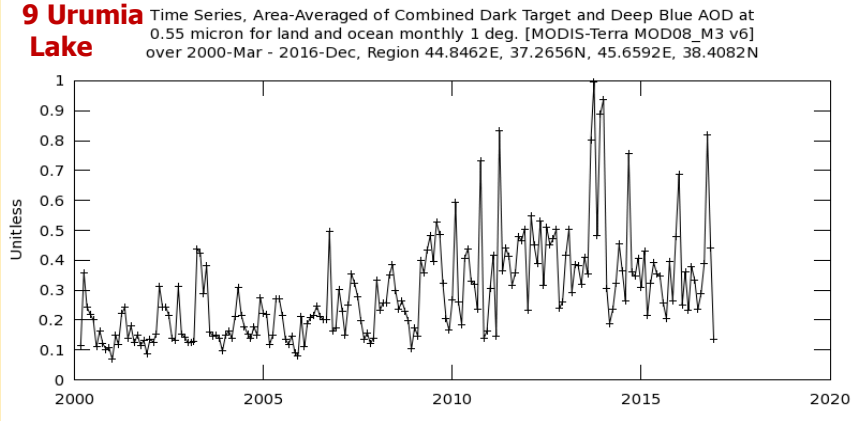
I) Sep



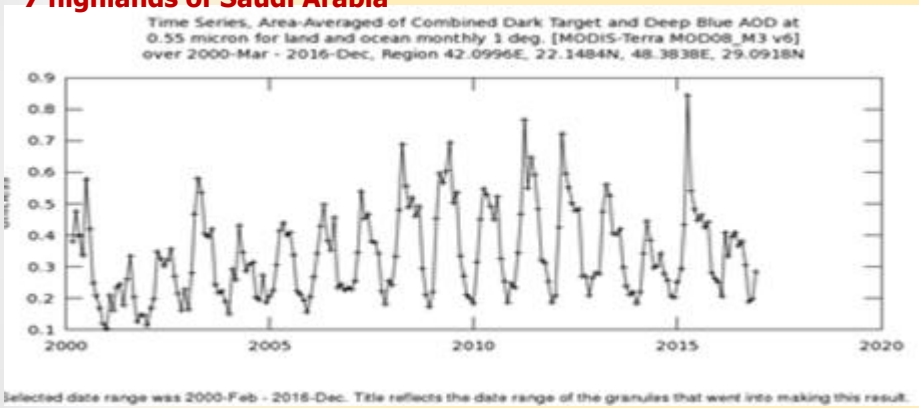
6 Empty Quarter



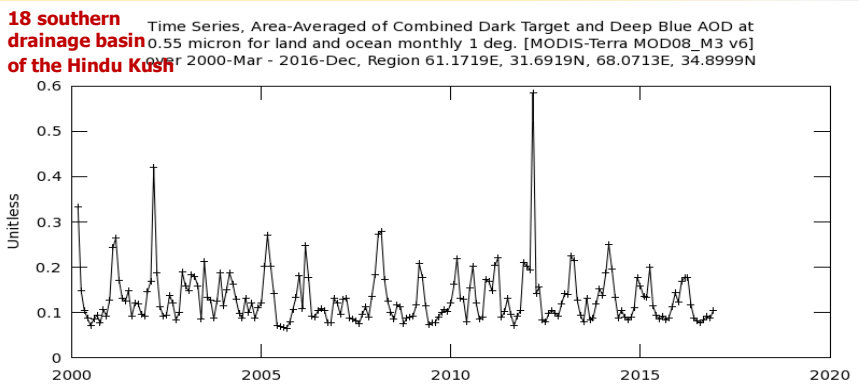
9 Urumia Lake



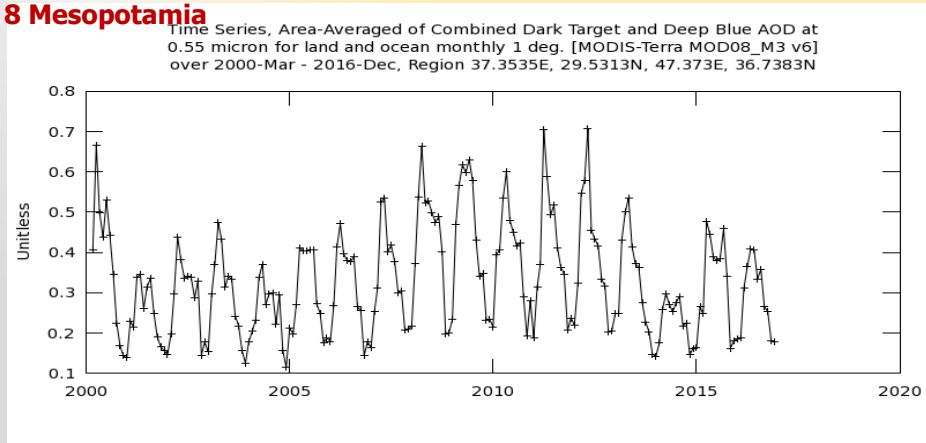
7 highlands of Saudi Arabia



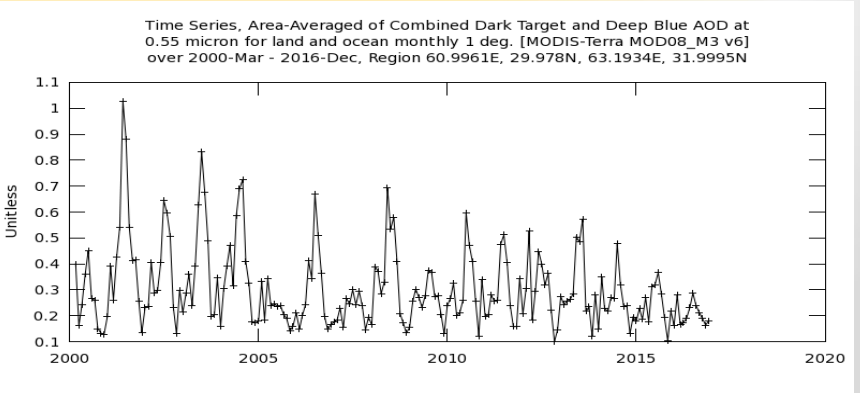
18 southern drainage basin of the Hindu Kush



8 Mesopotamia

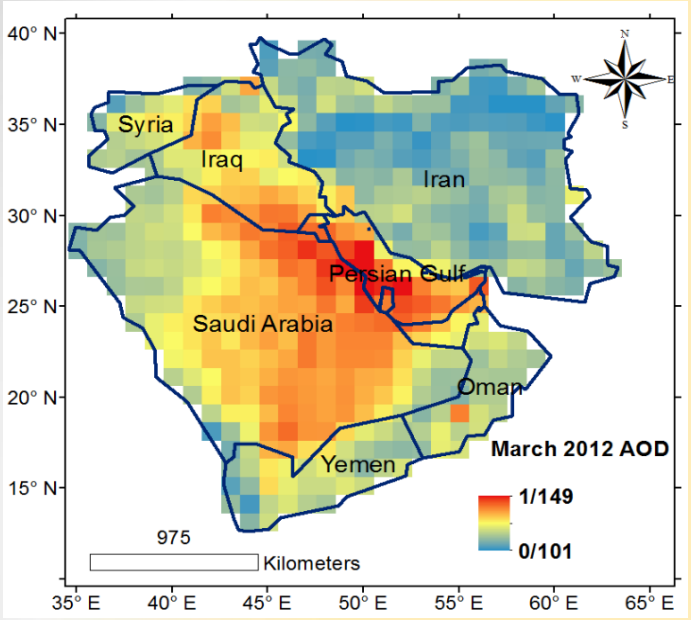


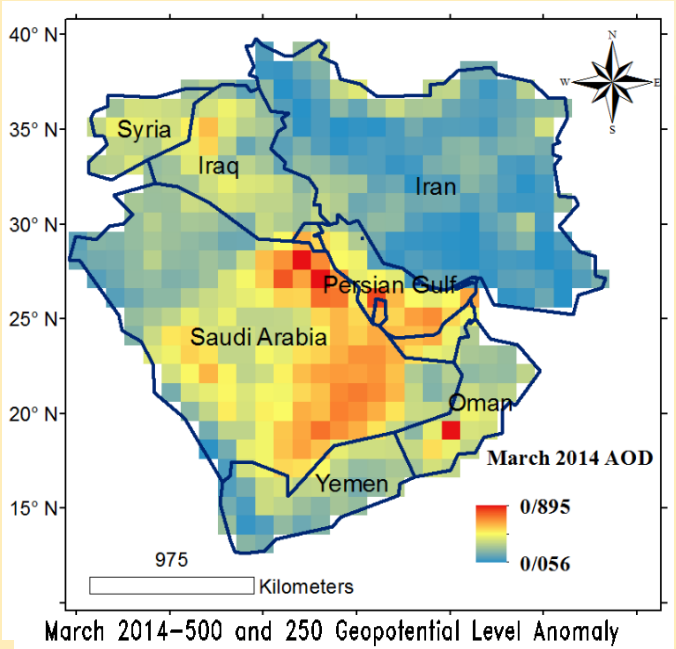
19 ephemeral lakes around the city of Zabol

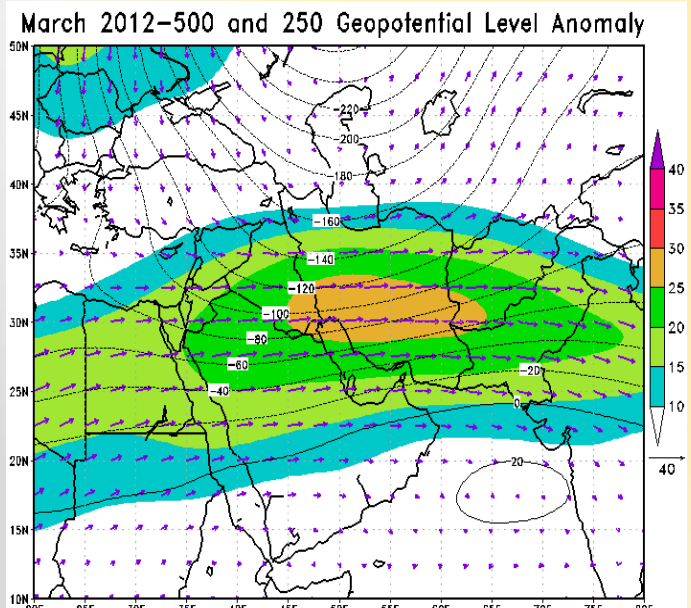


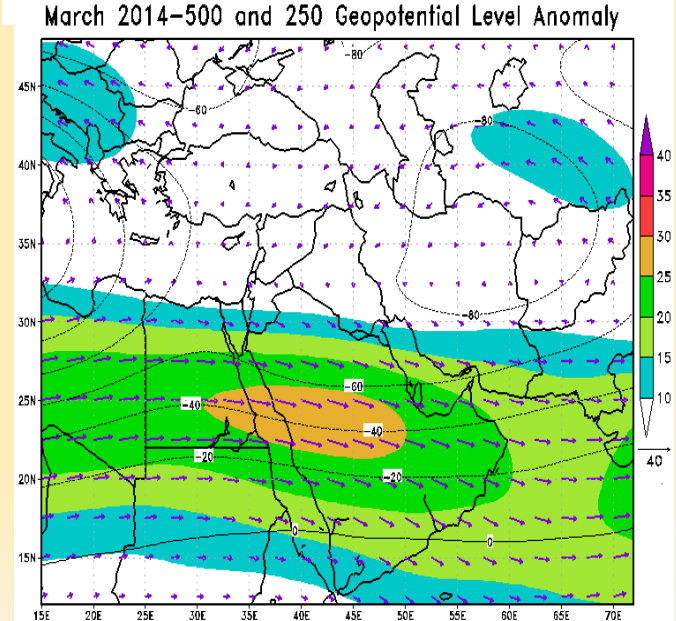
Impacts of climate and synoptic fluctuations on dust storm activity over the Middle East(Submitted to Atm. Env.)

Soodabeh Namdari, Neamat Karimi, Armin Sorooshian, GholamHasan Mohammadi[5], Saviz Sehatkashani





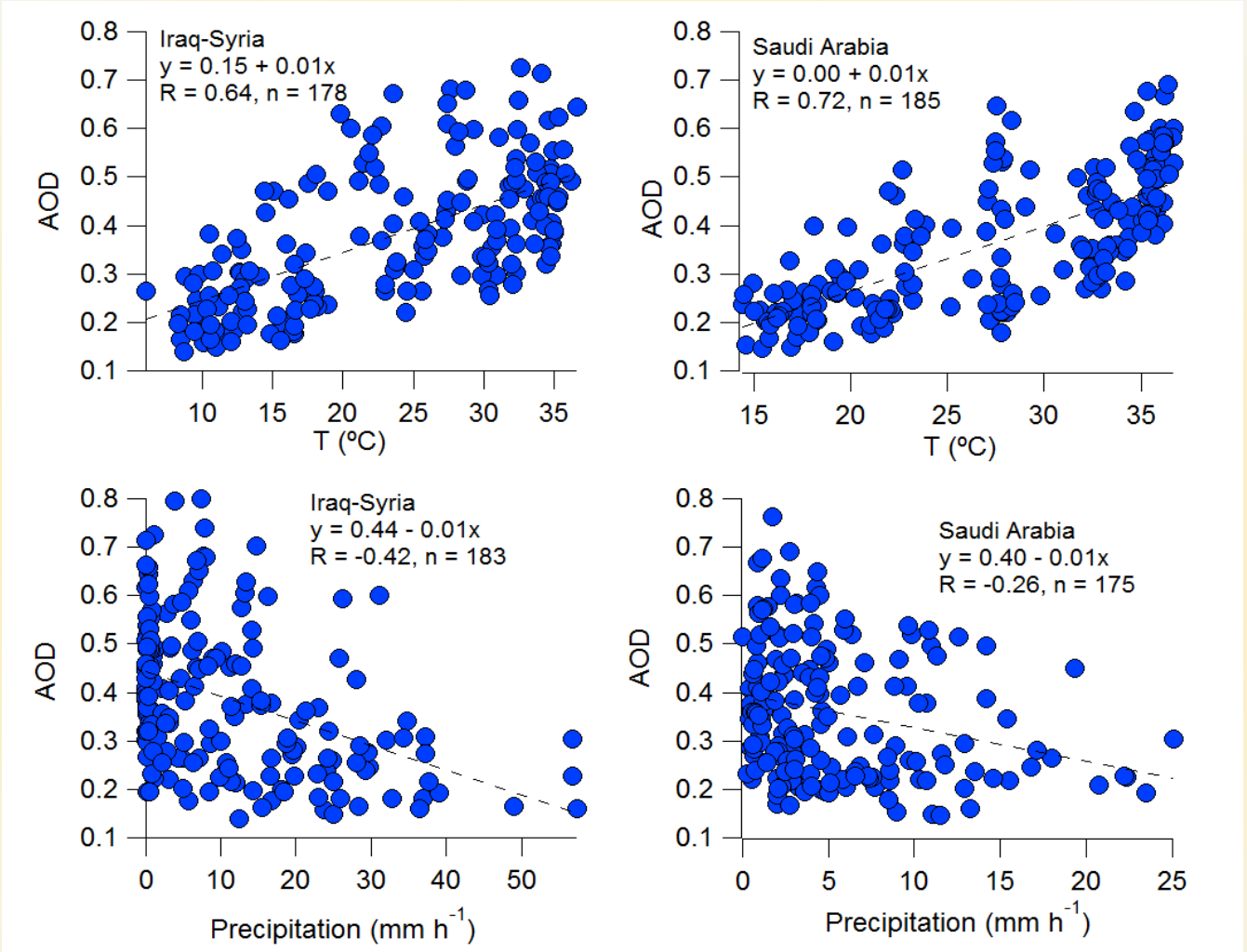




Monthly mean AOD in study region for March 2012 (left) and March 2014 (right).

Composite anomaly chart at 250 and 500 hPa. Colors denote wind speed anomaly (m s-1) and violet solid lines represent geopotential contour anomalies at 500 hPa

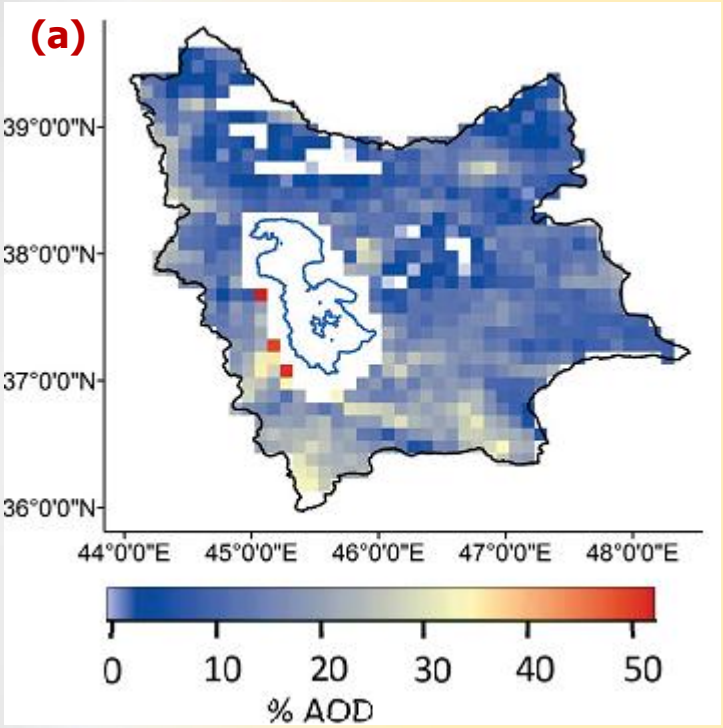
Impacts of climate and synoptic fluctuations on dust storm activity over the Middle East(Submitted to Atm. Env.)
Soodabeh Namdari, Neamat Karimi, Armin Sorooshian, GholamHasan Mohammadi[5], Saviz Sehatkashani

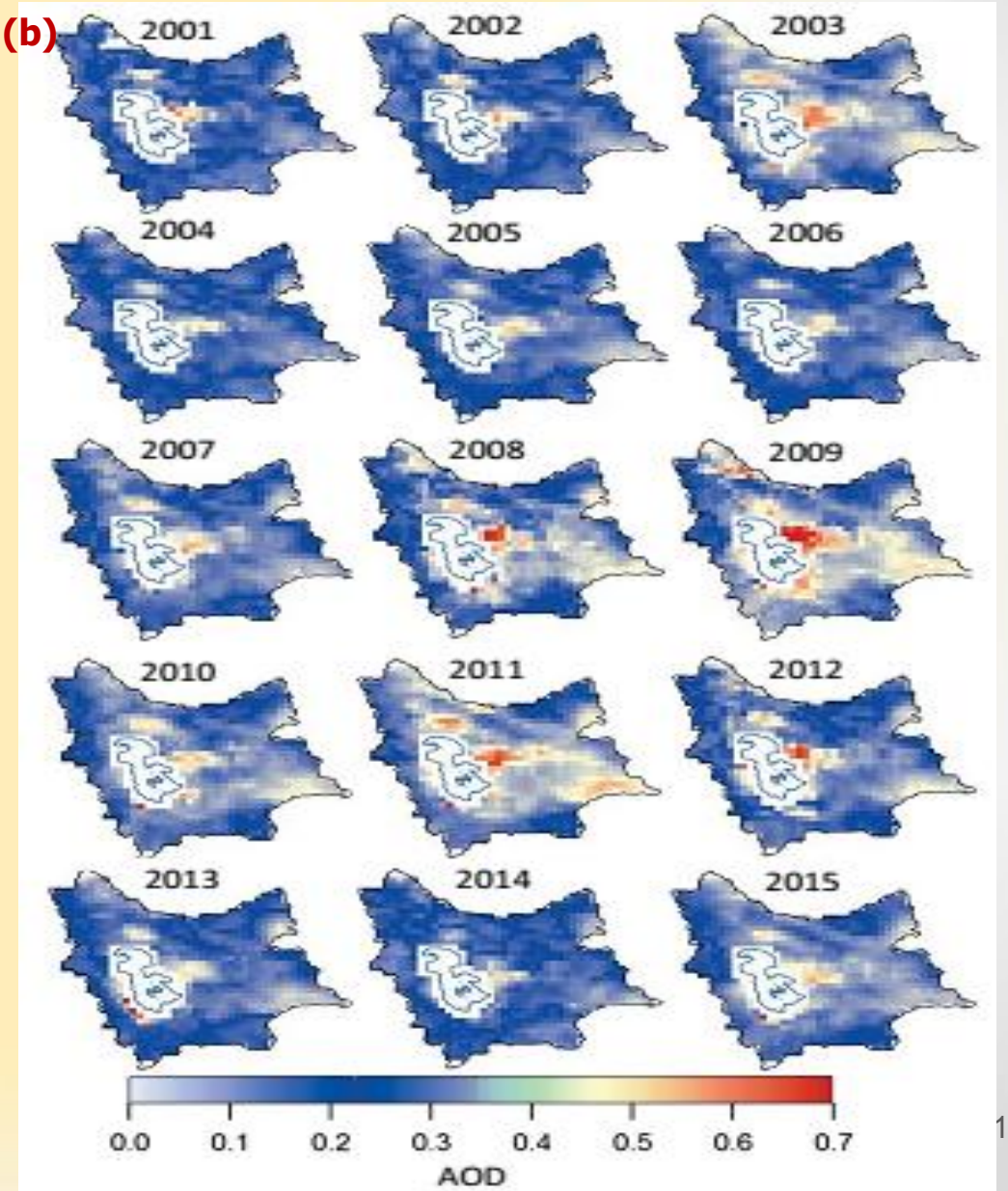


Correlations between AOD-Precipitation and AOD-Temperature for the entire region for all months between 2000-2015. Each marker represents a single month.

The Lake Urmia Environmental Disaster in Iran: A Look at Aerosol Pollution (submitted to PNAS)

Ali Hossein Mardi, Ali Khaghani, Alexander B. MacDonald, Armin Sorooshian, Phu Nguyen, Neamat Karimi, Parisa Heidary, Nima Karimi, Peyman Saemian, Massoud Tajrishy, Saviz Sehatkashani





(a) Spatial distribution of AOD percent change between 2008-2015 as compared to 2001-2007. Uncolored pixels represent an insufficient number of data points. (b) Spatial distribution of mean annual AOD for all years between 2001 and 2015. Uncolored pixels represent an insufficient number of data points.

Dust Enhancement Techniques

Dust RGB – How to get minimum of green ?

à frente do nosso tempo

Green: IR 10.8 – IR 8.7

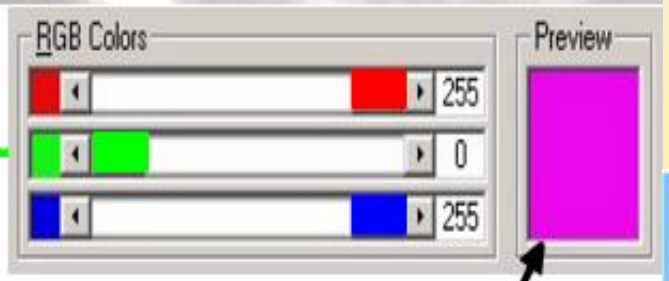
Range of values: 0 ... + 15 K

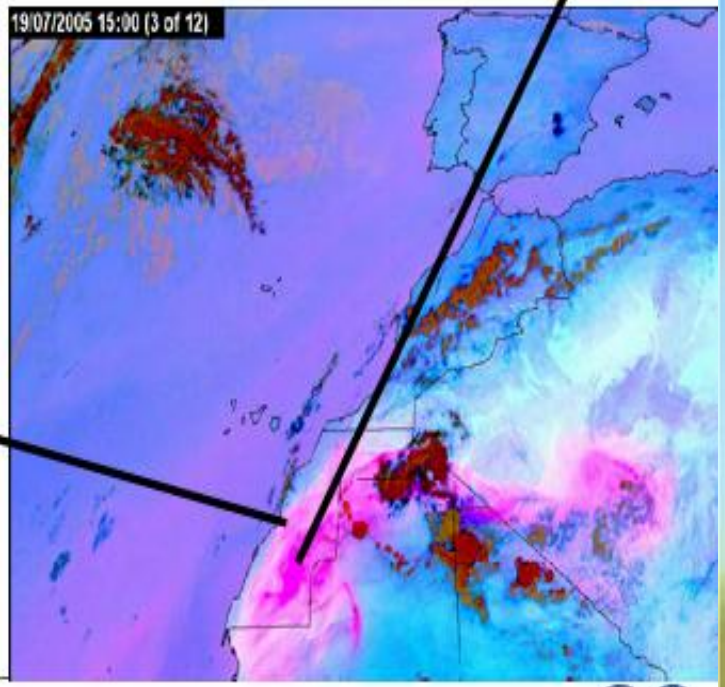
So No Green means

BT (IR10.8) – BT (IR8.7) = 0

Or : BT (IR 10.8) = BT (IR 8.7)

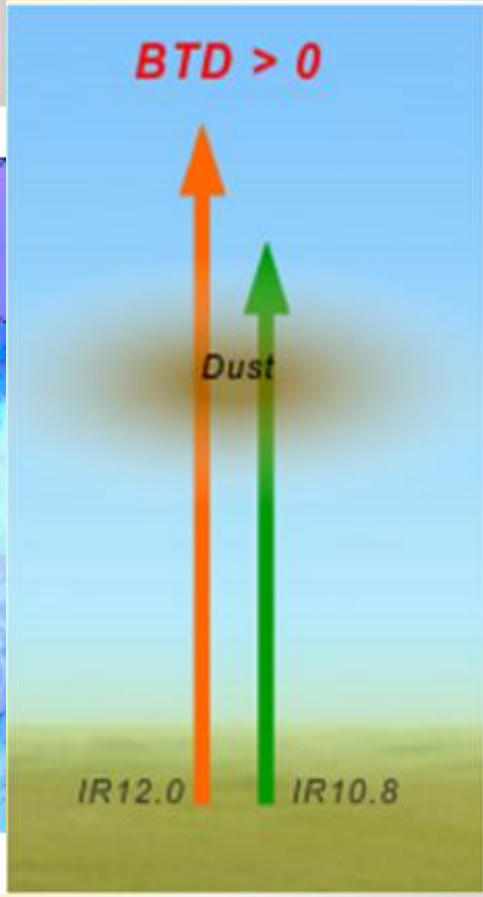
But dust is not always a full magenta !





So BT (IR 10.8) > BT (IR 8.7)

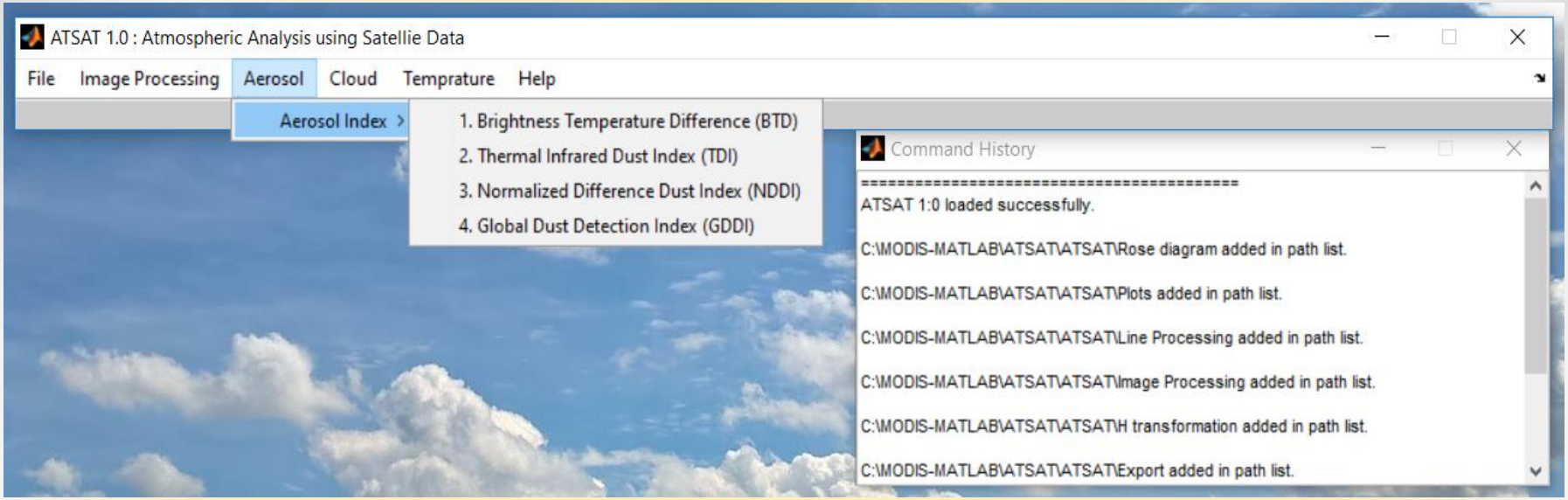
This case: BT (IR 10.8) - BT (IR 8.7) ~ 5 K



Ministério da Ciência e Educação
Instituto de Meteorologia, I. P. Rua C – Aeroporto de Lisboa 1749-077 Lisboa – Portugal Tel.: (351) 21 844 7000 Fax: (351) 21 840 2370 e-mail: informacoes@meteo.pt URL:

EUMETRAIN Module on RGB images:
http://www.eumetrain.org/resources/operational_use_rgb.html

Dust Classification, visibility and AOT estimation interface according to their physical properties



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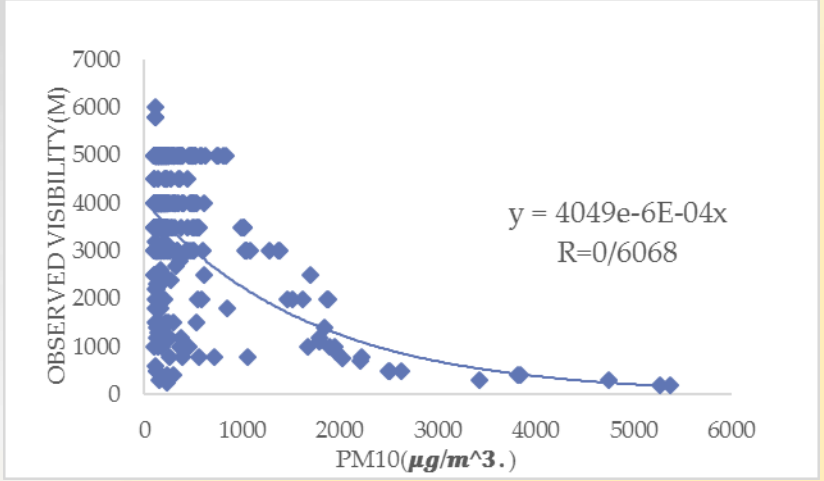
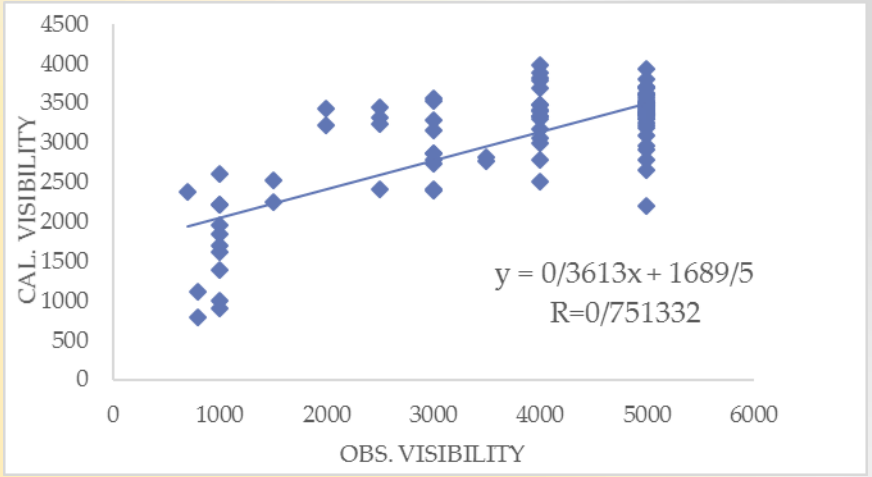
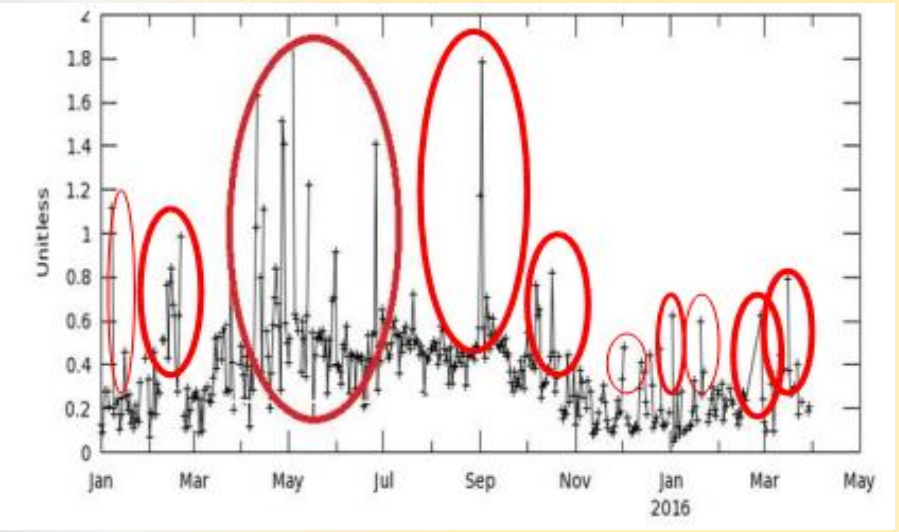
Dust detection and AOT estimation using combined VIR and TIR satellite images in urban areas of Iran

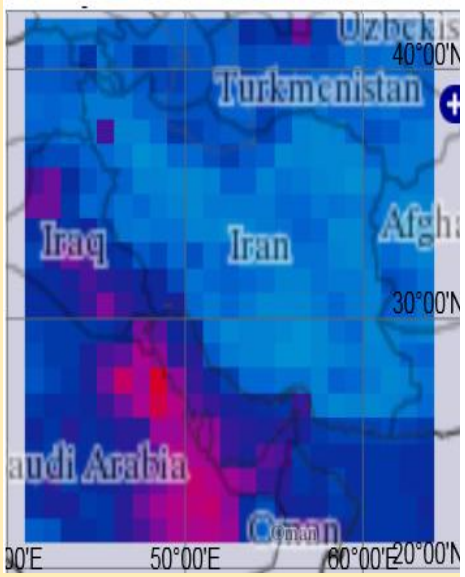
S. Sehatkashani[a], M. Vazifedoust[b,*], Gh. Kamali[a] and A.A. Bidokhti[c]

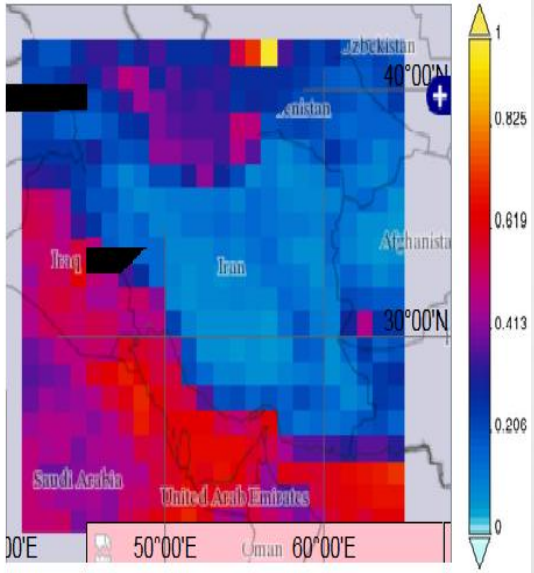






a combination of the AOD data retrieved using dark-target and deep blue (DB) algorithms. Daily level-3 products (collection 5.1), consisting of daily global gridded data of aerosol parameters at a resolution of (110 km)





AOD from MODIS, for October–April
2015–2016 (left column) and for May–September 2015–2016 (right column)

شماره مقاله
AQM2017-1122

پنجمین همایش ملی مدیریت آلودگی هوا و صدا
تهران – مرکز همایش های بین المللی رازی– بهمن ماه ۱۳۹۵

AQM 2017

معرفی یک معادله تجربی برای تخمین دید افقی با استفاده از غلظت ذرات معلق کمتر از ۱۰ میکرو متر در غرب و جنوب غرب ایران

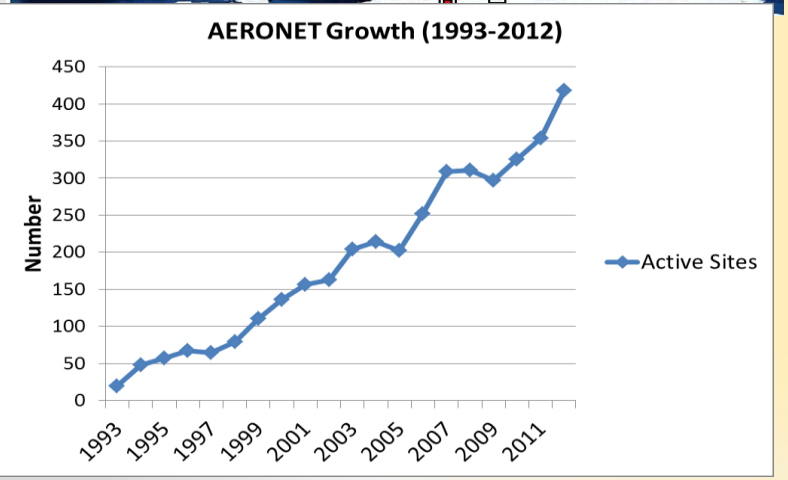
سحر تاج بخش[1]، ساویز صت کاشانی[1*]، مهدی رشیدزاد[2]، عباس رنجبر[1]

The importance of Ground-based remote sensing

AERONET Aerosol Robotic Network-Twenty Years of Observations and Research

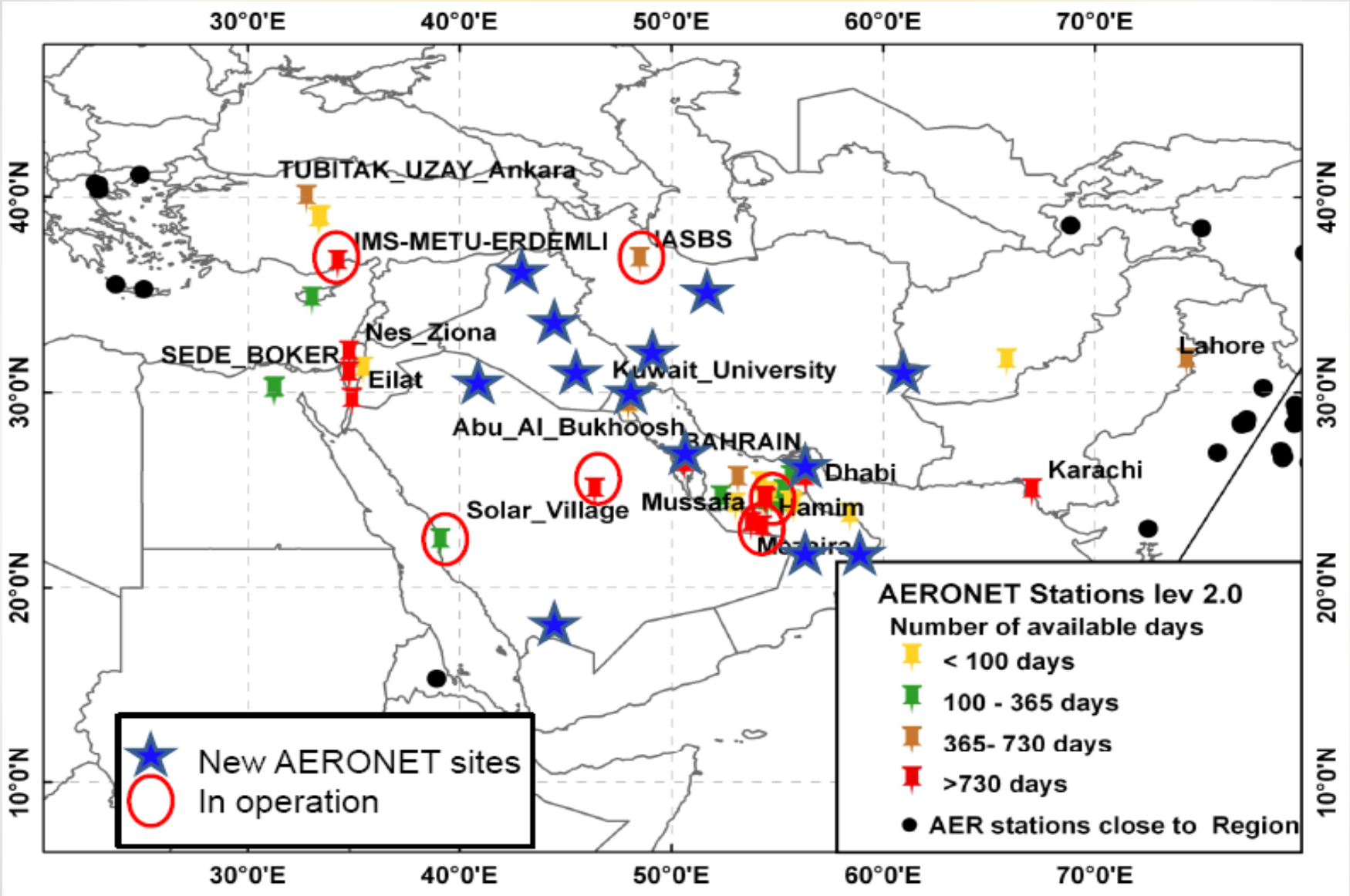
The AERONET program is a federation of ground-based remote sensing aerosol networks established by NASA and LOA-PHOTONS (CNRS) and has been expanded by collaborators from international agencies, institutes, universities, individual scientists and partners.

- >7000 citations
- >400 sites
- Over 80 countries
- http://aeronet.gsfc.nasa.gov



AERONET provides a long-term, continuous public database of aerosol optical, microphysical, and radiative properties for aerosol research and characterization, validation of satellite measurements, and synergism with other databases.

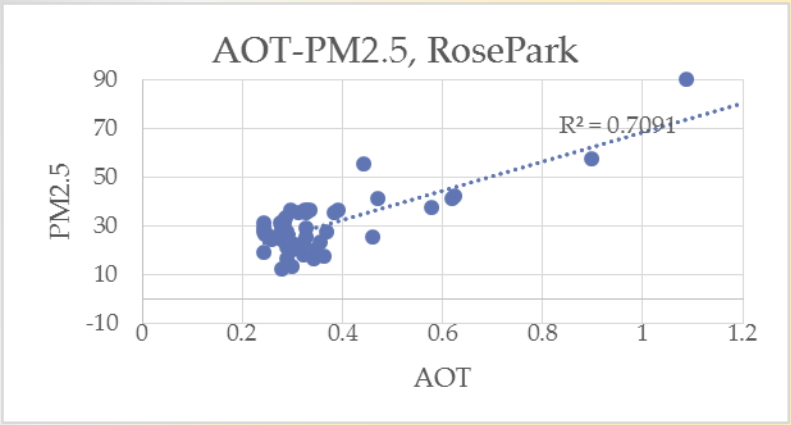
An Example of Current Needs for West Asia

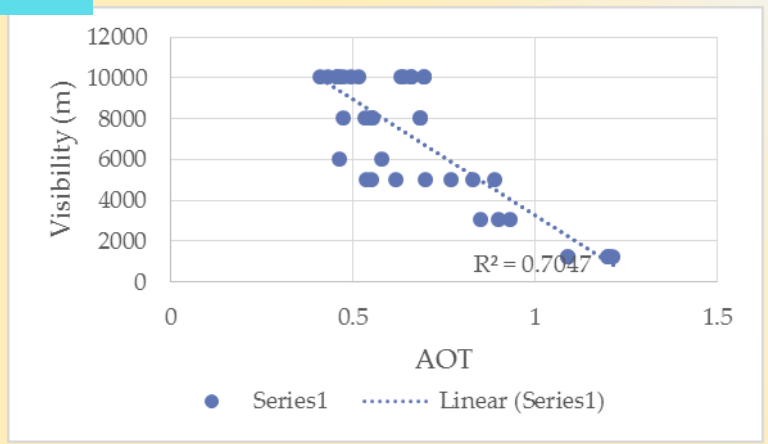


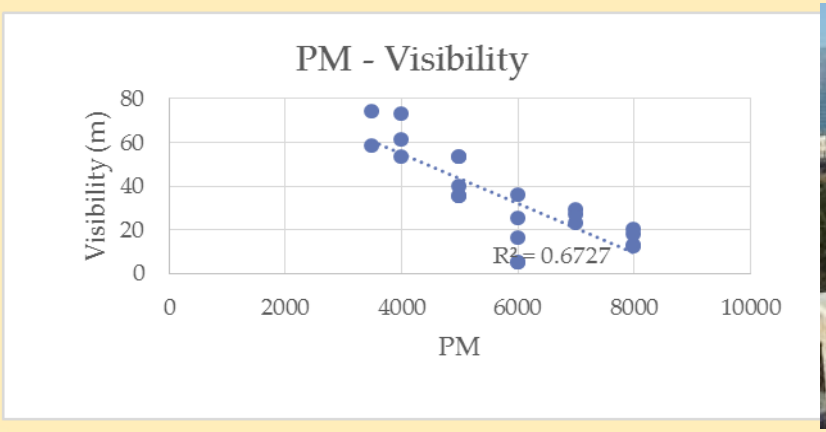
Ahvaz (Khuzestan), Zabol or Zahedan (Sistan basin) and Tehran + IASBS-Zanjan

Examples of cooperation between WMO SDS-WAS & IRIMO

GLOBE scientific-educational Programme







Aerosol characterization using Calitoo hand-held sunphotometer at the District 22 of Tehran (ASMERC)

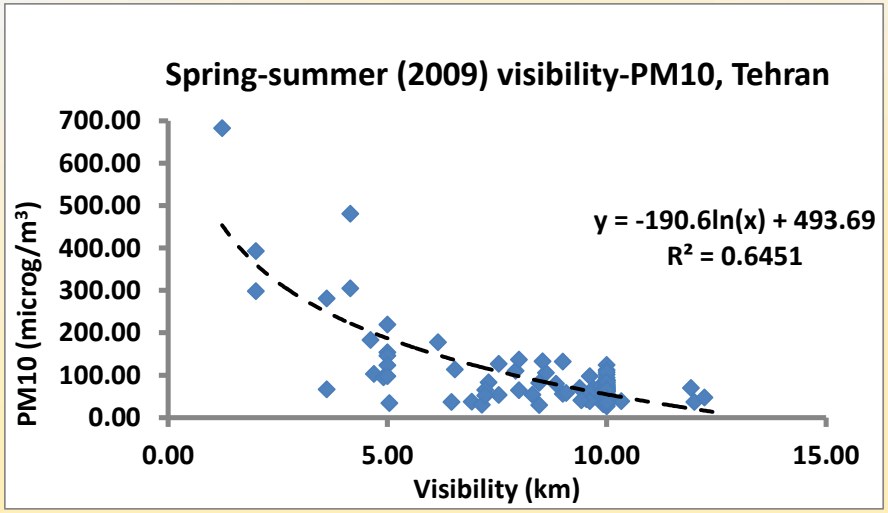
Saviz Sehatkashani[1], Amirhossein Nikfal[1], Carmen Guirado[2,3], Emilio Cuevas[2], Mehdi Rashidzad[1], Sergio Rodriguez[2], Abbas Ranjbar [1]

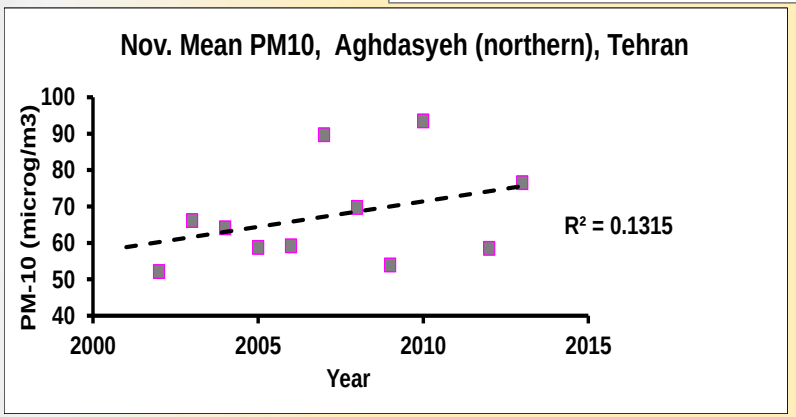
[1]Atmospheric Science and Meteorological Research Center (ASMERC), Tehran, Iran

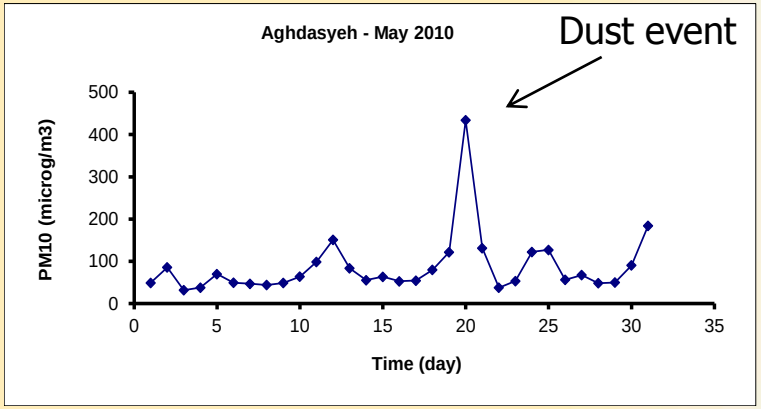
[2]Izaña Atmospheric Research Center (IARC), State Meteorological Agency of Spain (AEMET), Santa Cruz de Tenerife, Spain

[3]Atmospheric Optics Group, University of Valladolid (GOA-UVA), Valladolid, Spain

Keywords: Calitoo hand-held sunphotometer, Atmospheric aerosol, aerosol optical depth







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Some resilient aspects of urban areas to air pollution and climate change, case study: Tehran, Iran

A.A. Bidokhti[a,b], Z. Shariepour[b] and S. Sehatkashani[c,*]

In-situ dust characterization

PM_{10} & $PM_{2.5}$ sampeling

EN 12341 & 14907 methods

Weighting 20ºC
30-35% RH

GAW

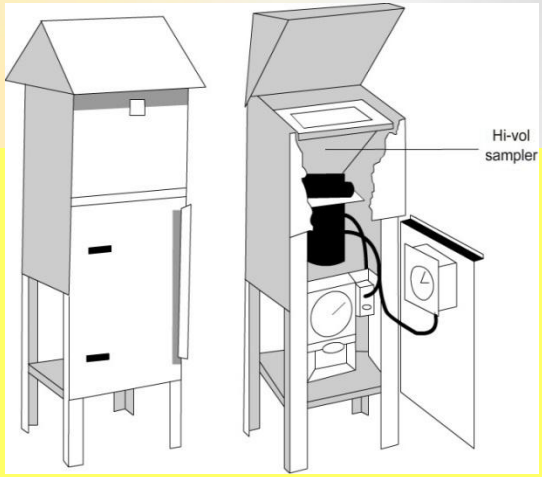
WORLD METEOROLOGICAL ORGANIZATION
WEATHER CLIMATE WATER

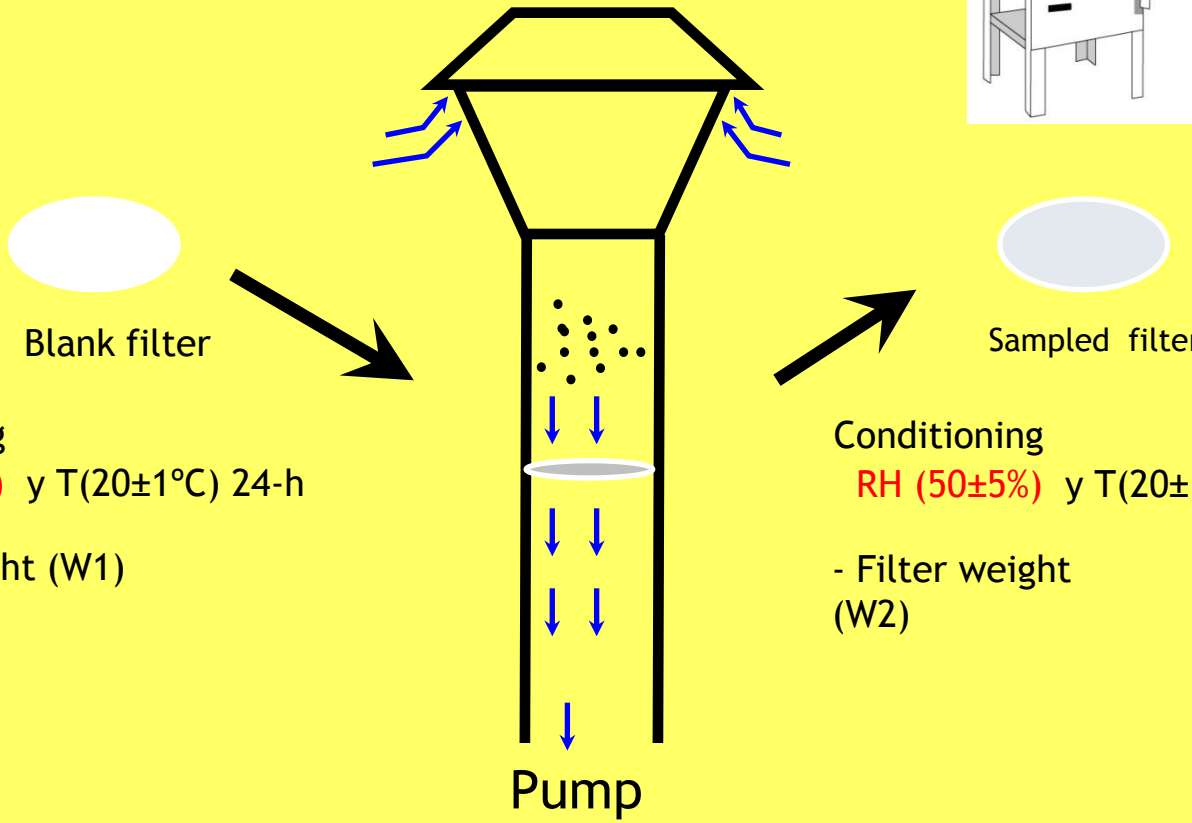
Global Global Atmospheric Watch Aerosol Programme

PM_{10} and $PM_{2.5}$ measurements in air quality networks

Reference method: gravimetric method

$$PM = \frac{(W2-W1)}{Volume}\ \mu g/m^3$$





Conditioning
RH (50±5%) y T(20±1°C) 24-h

- Filter weight (W1)

Conditioning
RH (50±5%) y T(20±1°C) 24-h

- Filter weight (W2)

Opportunities for future cooperation between WMO SDS-WAS & IRIMO

https://gawsis.meteoswiss.ch/GAWSIS//index.html#/

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Quick access

Generate station report by:

Station name

GAW ID

Generate station lists by:

Country

Type

Find people by:

Contact name

GAW World Data Centres

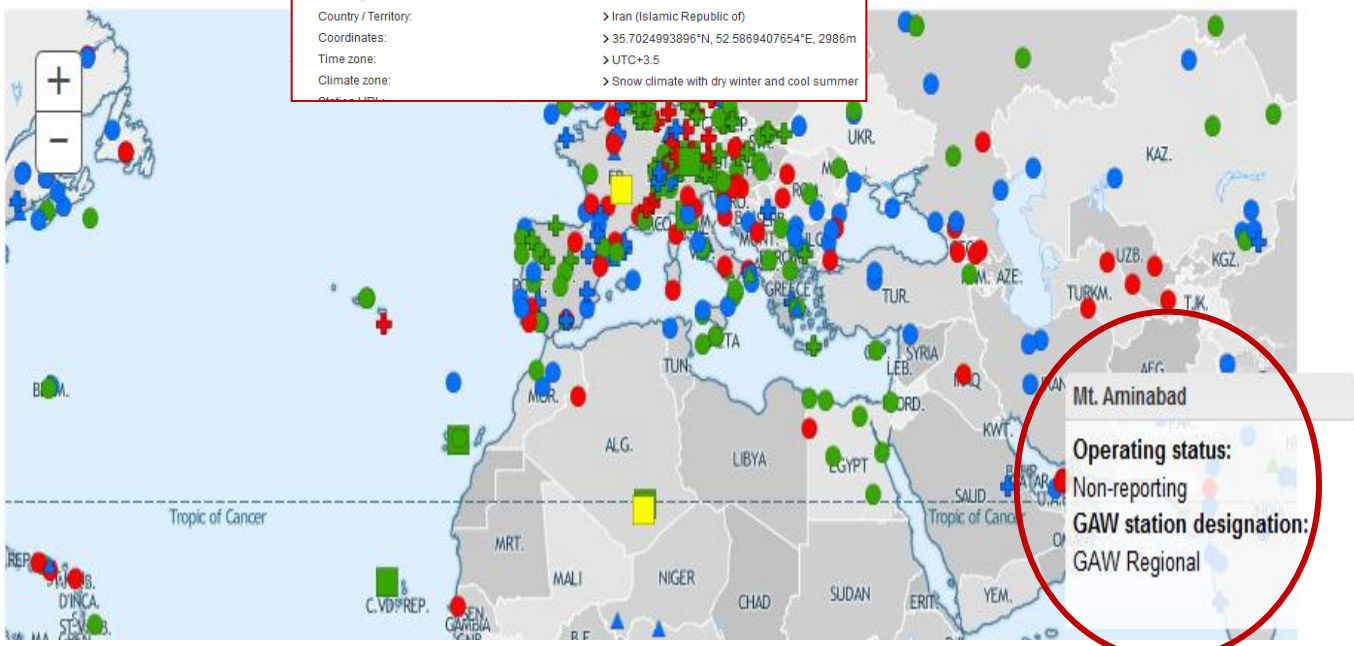
WDC-RSAT (World Data Center for Remote

Welcome to GAWSIS

Mt. Aminabad (Iran (Islamic Republic of))
GAW Regional station in WMO Region II - Asia

Station characteristics

Station name:	Mt. Aminabad
Station alias:	
Date established:	
Declared status:	Operational
Current recorded status:	Non-reporting
Station type:	Land (fixed)
Station class(es):	
GAW ID:	MAM
WMO index No:	0-20008-0-MAM
WMO region:	II - Asia
Country / Territory:	> Iran (Islamic Republic of)
Coordinates:	> 35.7024993896°N, 52.5869407654°E, 2986m
Time zone:	> UTC+3.5
Climate zone:	> Snow climate with dry winter and cool summer



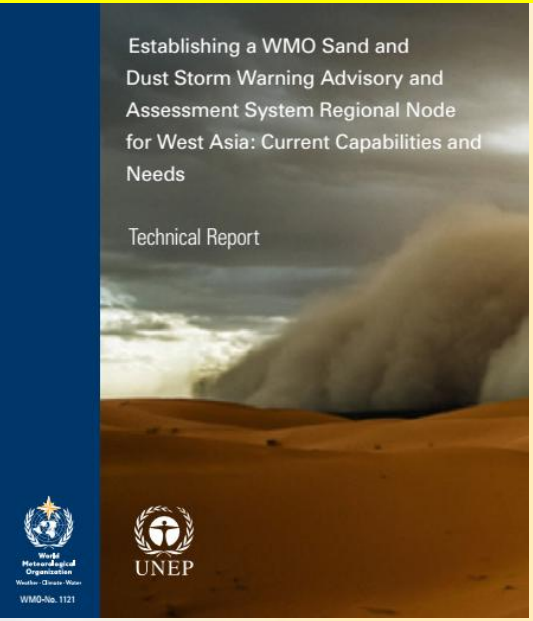
Programs / network affiliation:

Program / network affiliation	Program specific ID	Current recorded status	Declared status	From	To	Status
GAW Regional	MAM	Non-reporting	Operational	2016-04-28		Approved

Observations / measurements

There are no observations / measurements for this station

Opportunities for future cooperation between WMO SDS-WAS & IRIMO



In-situ dust characterization

An insufficient number of stations to monitor mineral dust (mainly PM10) are located in rural background conditions, which would provide information about its impact on air quality in cities. PM10 and PM2.5 measurements in urban air-quality networks represent a mix of anthropogenic pollution (vehicles, gas flares, industries, ships) and natural contributions. It is difficult to separate the contribution of each source if there are no background stations unaffected by anthropogenic contributions.

There are no standards of air quality – especially for PM10 – common to all countries of the region.

A regional centre for common and homogenized quality assurance is lacking.

Ground-based remote sensing

Furthermore, and from a climatological point of view, we have to take into account the fact that, while MODIS-DB completes a global coverage every one or two days, MISR has a global coverage every nine days. This means that AOD climatologies correspond to a quite different number of days, during which dust episodes might vary significantly.

These differences must be analysed and understood, using ground-based measurements as carried out by AERONET. As suggested by *Shi et al. (2011),* additional AERONET sites are required for some of the regions with large MODIS/MISR ratio values, especially where it is suspected that aerosol optical property assumptions cause large uncertainties in satellite retrievals. This is the case in most of the Middle East. The NRT comparison of satellite- and ground-based measurements constitutes a good quality-assurance system, which will give a confidence level to the data provided by satellite and correct them, if necessary.

Only together …

Source: UNICEF

سپاس

Sehat.s@asmerc.ir